FINAL
FEASIBILITY STUDY REPORT

LOWER LEY CREEK SUBSITE OF THE ONONDAGA LAKE SUPERFUND SITE
SYRACUSE, NEW YORK

EPA Contract No.: EP-W-10-007
Work Assignment Number: 007-RICO-024Q

Prepared for:
U.S. Environmental Protection Agency Region 2
290 Broadway
New York, NY 10007

January 2014

Los Alamos Technical Associates, Inc.

594315

HGL
HydroGeoLogic, Inc

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LIST OF ACRONYMS AND ABBREVIATIONS

AE	assessment endpoints
AFCEC	Air Force Civil Engineer Center
ARAR	applicable or relevant and appropriate requirements
ARCS	Assessment and Remediation of Contaminated Sediments
bgs	below ground surface
BERA	baseline ecological risk assessment
BNA	base/neutral/acid organic compounds
bwsi	below the water-sediment interface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHA	Clough, Harbour & Associates
CLU-IN	Clean-Up Information
COPC	chemicals of potential concern
CSM	Conceptual Site Model
CTE	central tendency exposure
CWA	Clean Water Act
DOA	U.S. Department of Agriculture
DOC	U.S. Department of Commerce
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
EA	EA Science and Technology
EPA	U.S. Environmental Protection Agency
ERT	Environmental Response Team
ETWG	Engineering/Technology Work Group
°F	degrees Fahrenheit
FACTS	Field Analytical and Characterization Technologies System
FRTR	Federal Remediation Technologies Roundtable
FS	feasibility study
ft	feet
GLNPO	Great Lakes National Program Office
GM	General Motors
GRA	general response action
HGL	HydroGeoLogic, Inc.
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient

IFG	Inland Fisher Guide
ITT	Innovative Treatment Technologies
LATA	Los Alamos Technical Associates
LOAEL	lowest observed adverse effect level
LUC	land-use control
mg/kg	milligrams per kilogram
MNR	monitored natural recovery
NCP	National Oil and Hazardous Substances Contingency Plan
NYCRR	New York Codes, Rules and Regulations
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no observed adverse effect level
NPL	National Priorities List
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	operations and maintenance
%	percent
PAH	polyaromatic hydrocarbons
PCB	polychlorinated biphenyls
PPE	personal protective equipment
ppm	parts per million
PRG	preliminary remediation goals
RACER™	Remedial Action Cost Engineering and Requirements
RA	remedial action
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
REACH IT	Remediation and Characterization Innovative Technologies
RG	remedial goal
RI	remedial investigation
RIMS	Remediation Information Management System
RME	reasonable maximum exposure
ROD	Record of Decision
RSL	regional screening levels
RTN	Remediation Technologies Network
SCO	Soil Cleanup Objective
SDA	sediment dewatering area
SEL	severe effect level
SERAS	Scientific, Engineering, and Analytical Services
Site	Lower Ley Creek Subsite of the Onondaga Lake Superfund Site

SITE	Superfund Innovative Technology Evaluation
SLERA	screening level ecological risk assessment
SVOC	semi-volatile organic compound
TBC	To Be Considered
TEC	total equivalent concentrations
TSCA	Toxic Substances Control Act
µg/L	micrograms per liter
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
VISITT	Vendor Information System for Innovative Treatment Technologies
VOC	volatile organic compound
WA	Work Assignment
WAF	Work Assignment Form

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EXECUTIVE SUMMARY

This Remedial Investigation/Feasibility Study (RI/FS) for Lower Ley Creek Subsite of the Onondaga Lake Superfund Site (the Site) is being performed under U.S. Environmental Protection Agency (EPA) RAC2 Contract Number EP-W-10-007 (Work Assignment Number 007-RICO-024Q) with Los Alamos Technical Associates, Inc. (LATA). HydroGeoLogic, Inc. (HGL) is a Team Subcontractor to LATA on this contract and has the lead technical role for this Work Assignment (WA). The Original WA Form (WAF) for the RI/FS to be performed by LATA for this Site was issued and received on 02 March 2012.

HGL has been tasked by LATA to prepare this Final FS for the Site. In accordance with the approved Work Plan dated 15 August 2012, the purpose of this Final FS is to:

- Establish Remedial Action Objectives (RAO).
- Establish General Response Actions.
- Identify and Screen Applicable Remedial Technologies.
- Develop Remedial Alternatives in accordance with the National Contingency Plan (NCP).
- Screen Remedial Alternatives for Effectiveness, Implementability, and Cost.
- Assess each individual alternative against the evaluation criteria.
- Perform a comparative analysis of all options against the evaluation criteria.

SITE LOCATION AND DESCRIPTION

The Site (CERCLIS ID No. NYD986913580) consists of the lower 2 miles of Lower Ley Creek, beginning at the upstream portion of the Route 11 (a.k.a. Brewerton Road) Bridge and ending downstream at Onondaga Lake. The Site also includes the Old Ley Creek Channel, originally a portion of the original Ley Creek prior to its rerouting in the 1970s. The Site is a subsite of the Onondaga Lake Superfund Site, which was listed on the National Priorities List (NPL) on 16 December 1994. The creek passes through the Salina Landfill and under the 7th North Street Bridge and Interstate 81 bridges. The banks of the stream channel are near vertical in most areas, and the channel is very well defined. The bottom of the stream is dominated by soft sediment with very little stone or other hard surfaces. Much of the stream is shallow, but there are sections where the water depth may be 8-10 feet (ft) deep, particularly downstream of the 7th North Street Bridge. The creek, in general, is narrower and shallower upstream of the 7th North Street Bridge, and wider and deeper downstream of 7th North Street Bridge. The immediate banks of the stream are bordered predominantly by herbaceous vegetation. Some woody shrubs are also mixed in with herbaceous vegetation and sections of the bank are wooded. Beyond the narrow strip of vegetation, the creek is surrounded by manufacturing operations, parking lots, a landfill, and railroad tracks that parallel and are a short distance from much of the southern bank. The creek trends north and then southwest in the last 500 ft before passing under the railroad tracks where it enters Onondaga Lake. The Site is located within the urbanized area of Eastern Syracuse, New York.

NATURE AND EXTENT OF CONTAMINATION

In 2010, the New York State Department of Environmental Conservation (NYSDEC) tasked EA Engineering, P.C., and its affiliate EA Science and Technology (EA), to perform an RI at the Old Ley Creek Channel. During the most recent investigation (concluded in 2012), the EPA Scientific, Engineering, and Analytical Services (SERAS)/Environmental Response Team (ERT) collected fish tissue samples, surface water samples, soil samples, and sediment samples to characterize the nature and extent of contamination at Lower Ley Creek.

<u>Lower Ley Creek</u>

The fish tissue samples exhibited detectable concentrations of metals, organic compounds, polychlorinated biphenyls (PCB), and dioxins/furans. Ecological risks exist from concentrations of dioxins and PCBs in the fish tissue. In addition, human health risks exist from the potential consumption of contaminated fish from Lower Ley Creek. The primary human health risk drivers in the fish tissue are PCBs, arsenic, and mercury.

The surface water samples exhibited detections of metals, volatile organic compounds (VOC), and base/neutral/acid organic compounds (BNA). No metals or VOCs were detected above NYSDEC Water Quality Standards. BNAs were detected at or above their respective NYSDEC Water Quality Standards at several surface water sample locations.

PCBs were not detected in surface water samples collected during this investigation. However, surface water samples collected during the baseline monitoring program for the Lake Bottom Subsite of the Onondaga Lake Superfund Site in 2011 (samples collected by Honeywell) exhibited PCB concentrations ranging from 0.048 to 0.23 micrograms per liter (μg/L), which is above the NYSDEC Water Quality PCB Standard of 0.09 μg/L when used as a human water source. For human fish consumption, 1×10^{-6} μg/L is the NYSDEC Water Quality PCB Standard.

Soil samples were collected along the banks and dredged spoils areas adjacent to Lower Ley Creek. Soil samples exhibited detections of pesticides, metals, cyanide, PCBs, VOCs, BNAs, and dioxins/furans. Pesticides, metals, PCBs, VOCs, and BNAs were detected above their respective unrestricted use New York State (NYS) soil criteria. Metals, PCBs, and BNAs were detected above their respective restricted use NYS soil criteria for commercial use and their respective ecological use values. Although the dioxins/furans detected in soil do not have NYS soil criteria for comparison, some dioxins/furan analytical results were above the EPA preliminary remediation goal (PRG) for dioxins in residential soil.

Sediment samples were collected along the entire 2 mile length of the Lower Ley Creek Site. Sediment samples exhibited detections of pesticides, metals, cyanide, PCBs, VOCs, BNAs, and dioxins/furans. Pesticides, metals, mercury, PCBs, VOCs, and BNAs were detected above their respective unrestricted use NYS sediment criteria. Cyanide and the dioxins/furans detected in sediment samples have no NYS sediment criteria for comparison. However, some dioxins/furans in sediment were detected above the EPA preliminary remediation goal for dioxins in residential soil.

The major areas of contamination in soil are present where spoils associated with the dredging of Lower Ley Creek were reportedly deposited. Soil contamination extends from the surface to as deep as 14 ft below ground surface (bgs). The major areas of contamination in sediment are in the upstream portion of Lower Ley Creek, with decreasing concentrations towards Onondaga Lake. Sediment contamination extends from the surface to as deep as 8 ft below the water sediment interface (bwsi). The contamination in the sediment is likely influencing the contamination also present in fish tissue and surface water samples.

<u>Old Ley Creek Channel</u>

The Old Ley Creek Channel is approximately 1,350 ft in length and flows from northeast to southwest draining to Ley Creek. The contaminants identified in the Old Ley Creek Channel RI performed by EA in 2010 included:

- VOCs, semi-volatile organic compounds (SVOC), metals, pesticides, and PCBs were detected in groundwater but exhibited limited impact. Some metals were detected at concentrations greater than their respective NYSDEC Water Quality Standards.
- Metals, pesticides, and PCBs were present in surface water during two of the sampling rounds at concentrations greater than their respective NYSDEC Water Quality Standards.
- SVOCs, PCBs, and metals were present in soils above NYSDEC restricted use soil criteria from the surface to several ft below grade with the highest concentrations being within the first 2 ft. Only limited low-level impacts to soils by VOCs were identified.
- VOCs, SVOCs, pesticides, PCBs, and metals were present in sediment above NYSDEC sediment criteria from the surface to 2 ft below grade.

REMEDIAL ACTION OBJECTIVES

RAOs are developed to specify the requirements that the remedial action alternatives must fulfill to protect human health and the environment. The RAOs developed for the Site are:

<u>Soil RAOs</u>

- Reduce the cancer risks and non-cancer health hazards to human health from the incidental ingestion of and dermal contact with contaminated soil.
- Prevent migration of contaminants that would result in surface water contamination at levels that are associated with unacceptable ecological risk.
- Remediation of soil to levels that are of acceptable ecological risk.

<u>Lower Ley Creek RAOs</u>

- Prevent the direct contact with contaminated sediments.
- Reduce the cancer risks and non-cancer health hazards for people eating fish from Lower Ley Creek by reducing the concentration of contaminants in fish.
- Prevent releases of contaminant(s) from sediments that would result in surface water levels in excess of ambient water quality criteria.

- Prevent impacts to biota from ingestion/direct contact with sediments causing toxicity or impacts from bioaccumulation through the marine or aquatic food chain.
- Restore sediments to pre-release/background conditions to the extent feasible.
- Reduce the risks to ecological receptors by reducing the concentration of contaminants in fish.
- Minimize the current and potential future bioavailability of contaminants in sediments. Contaminants in sediments may become bioavailable by various mechanisms (e.g., pore water diffusion, bioturbation, biological activity, benthic food chains, ice jam scour, etc.).

CLEANUP GOALS

The Site is located within a highly urbanized area of Eastern Syracuse, New York. Lower Ley Creek is surrounded by manufacturing operations, parking lots, a landfill, railroad tracks, and commercial operations. This has been a commercial/industrial area for at least 50 years and will continue to be a commercial/industrial area for the foreseeable future. However, the Site also contains an undeveloped riparian corridor that includes Old Ley Creek, Lower Ley Creek, and the adjacent wetlands and floodplains associated with these surface water bodies. Therefore, cleanup goals are based both on commercial use and the protection of ecological resources.

As documented in the Record of Decision (ROD) for the Crouse-Hinds Landfills State Superfund Project (Site No. 734004), located along the southern shore of Lower Ley Creek, the cleanup goal of 1 milligram per kilogram (mg/kg) PCBs in creek sediment is recognized as a previously selected sediment cleanup goal at NYS Hazardous Waste Sites. Therefore, 1 mg/kg PCBs was used as a cleanup goal for sediments at Lower Ley Creek. Additional areas exhibiting sediments below 1 mg/kg PCBs were added to the sediment remedial alternatives based on elevated concentrations of other risk drivers (i.e., chromium and polyaromatic hydrocarbons [PAH]).

Cleanup goals for soil were based on 6 NYCRR Part 375 Soil Cleanup Objectives (SCO) for Commercial Use and the Protection of Ecological Resources. Although the area is a riparian corridor, widespread landfilling exists beneath much of the soil areas and the surrounding land use is industrial and commercial. For soils shallower than 2 ft bgs, the lower value between Commercial Use SCOs and Ecological SCOs was used as a cleanup goal. For soils deeper than 2 ft bgs, Commercial Use SCOs were used as cleanup goals as there are very limited ecological pathways and exposures deeper than 2 ft bgs.

SOIL REMEDIAL ALTERNATIVES

To assist with the determination of remedial alternatives for soil, site soils have been separated into two areas (Southern Swale Soils and Northwest Soils). This separation was made because there are specific remedial challenges associated with each area. While the Northwest Soil area has two large buried pipelines to consider, remediation of the Southern Swale Soil area may require limited wetland restoration. Four soil remedial alternatives (including the No Action alternative) were developed, screened, and evaluated for the Site.

Soil-1: No Action

Soil Alternative 1 is the No Action alternative and is presented for comparison only. The No Action Alternative consists of refraining from the active application of any remediation technology to soils of Lower Ley Creek. The No Action alternative also excludes source control removal action, administrative actions, and monitoring. As required by Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), periodic reviews would be conducted at 5-year intervals to reassess the long-term appropriateness of continued No Action.

The No Action alternative would not actively reduce the toxicity, mobility, or volume of the contamination through treatment. The cancer risks and non-cancer human health hazards and risks to ecological receptors would continue to remain above acceptable levels and the surface water quality would continue to be degraded.

Soil-2: Excavation of Soil to Meet Cleanup Goals

Soil Alternative 2 includes both excavation and installation of a soil cap in select locations. In the Southern Swale Soil Area, all soils with concentrations above cleanup goals would be excavated. In the Northwest Soil Area, all soils above with concentrations above cleanup goals would be excavated, except in areas near the two pipelines located adjacent to each other in the Northwest Soil Area. One pipeline is an active natural gas line while the other pipeline is an inactive oil line. Based on restrictions imposed on the field sampling team during the site investigation and discussions with utilities, it is likely that there will be a 20-ft wide “safety zone” digging restriction near the pipelines. Therefore, in areas of soil contamination adjacent to and above the pipelines, a soil cap would be installed.

This alternative includes excavation and either on-site or off-site disposal of soils exceeding cleanup goals. Clean backfill would then be placed to bring the excavation back to the original grade. At least 6 inches of topsoil would be placed over disturbed areas and seeded to grow vegetation to reduce or eliminate erosion from the disturbed areas.

This alternative also includes a soil cap for soils located adjacent to and above the pipelines. The soil cap would be a 1-ft thick layer of clean soil to isolate the contaminated soils. The soil cap would be a vegetated habitat layer. A demarcation layer (e.g., non-woven geotextile) would be installed between the contaminated soil and the soil cap. The soil cap would be seeded to grow vegetation that would reduce or eliminate erosion from the areas. In floodplain areas, an excavation of 1 ft of soil would be completed before the soil cap is installed to avoid loss of floodplain capacity. In addition, this alternative would require a site management plan to manage the soil cap and the remaining contamination at the site.

As part of this alternative, controls would be implemented as part of a site management plan to restrict excavation and construction activities in the soil cap areas. Institutional controls could include, but would not be limited to, potential land-use controls (LUC), environmental easements, deed notices, and public health advisories. Additional controls would likely include fencing and signage.

This alternative significantly reduces the risks to human health and the environment from soil contamination at the site. This conclusion is based on a combination of factors that includes the area remediated and the volume of soils removed. This is the most extensive soil remedial alternative, and as such provides the greatest benefits at the highest costs. It serves as the upper bound of the benefits of active remediation of soils at Lower Ley Creek.

Soil-3: Excavation of Southern Swale Soils to Meet Cleanup Goals and Soil Cap for Northwest Soils

Soil Alternative 3 includes both excavation and installation of a soil cap in select locations. In the Southern Swale Soil Area, all soil with concentrations above cleanup goals would be excavated to meet the cleanup goal. In the Northwest Soil Area, all soils with concentrations above cleanup goals would either be excavated or covered with a soil cap. Clean backfill would then be placed to bring the excavation back to the original grade. At least 6 inches of topsoil would be placed over disturbed areas and seeded to grow vegetation to reduce or eliminate erosion from the disturbed areas.

This alternative also includes a soil cap for some soils located in the Northwest Soil Area. The soil cap would be a 1-ft thick layer of clean soil to isolate the contaminated soils. The soil cap would be a vegetated habitat layer. A demarcation layer would be installed between the contaminated soil and the soil cap. A 2-ft thick habitat layer will be placed above the soil cap and will be seeded to grow vegetation that would reduce or eliminate erosion from the areas. Vegetation in the soil cap areas would be restored, including trees and shrubs, to create a riparian buffer.

In all areas, an excavation of 3 ft of soil would be completed before the soil cap is installed so there is no loss of floodplain capacity. Due to this requirement, soil caps will only be placed in areas exhibiting contamination deeper than 3 ft bgs. Any areas with contamination less than 3 ft deep will be excavated and replaced with backfill.

As part of this alternative, controls would be implemented as part of a site management plan to restrict excavation and construction activities in the soil cap areas. Institutional controls could include, but would not be limited to, potential LUCs, environmental easements, deed notices, and public health advisories. Additional controls would likely include fencing and signage.

This alternative significantly reduces the risks to human health and the environment from soil contamination at the Site. This conclusion is based on a combination of factors that includes the area remediated and the volume of soils removed. This is the next most extensive and expensive soil remedial alternative after Soil Alternative 2. This alternative appears to provide a good balance in achieving the RAOs and cleanup goals at costs that are more moderate as compared to Soil Alternative 2. Similar to Alternative 2, this alternative also addresses the most contaminated soils at the Site.

Soil-4: Soil Cap Over All Contaminated Soils

Soil Alternative 4 includes the excavation or installation of a soil cap over all soils exhibiting concentrations above cleanup goals in both the Southern Swale Soil Area and the Northwest Soil Area.

This alternative also includes a soil cap for some soils located in the Southern Swale Soil Area and the Northwest Soil Area. The soil cap would be a 1-ft thick layer of clean soil to isolate the contaminated soils. The soil cap would be a vegetated habitat layer. A demarcation layer would be installed between the contaminated soil and the soil cap. A 2-ft thick habitat layer will be placed above the soil cap and will be seeded to grow vegetation that would reduce or eliminate erosion from the areas. Vegetation in the soil cap areas would be restored, including trees and shrubs, to create a riparian buffer.

In all areas, an excavation of 3 ft of soil would be completed before the soil cap is installed so there is no loss of floodplain capacity. Due to this requirement, soil caps will only be placed in areas exhibiting contamination deeper than 3 ft bgs. Any areas with contamination less than 3 ft deep will be excavated and replaced with backfill.

As part of this alternative, controls would be implemented as part of a site management plan to restrict excavation and construction activities in the soil cap areas. Institutional controls could include, but would not be limited to, potential LUCs, environmental easements, deed notices, and public health advisories. Additional controls would likely include fencing and signage.

This alternative significantly reduces the risks to human health and the environment from soil contamination at the site. As with Soil Alternative 3, this alternative appears to provide a good balance in achieving the RAOs and cleanup goals at costs that are more moderate as compared to Soil Alternative 2.

SEDIMENT REMEDIAL ALTERNATIVES

To assist with the determination of remedial alternatives for sediment, the 2-mile stretch of the Lower Ley Creek Subsite has been separated into three sections (upstream, middle, and downstream). This separation was made because the downstream section of the Site exhibits lower concentrations of contaminants and a smaller extent of contamination than the upstream or middle sections of the Site. In addition, the upstream and middle sections of the site exhibit distinctive stream characteristics. Five sediment remedial alternatives (including the No Action alternative) were developed and screened for the Site.

<u>Sediment-1: No Action</u>

Sediment Alternative 1 is the No Action alternative and is presented for comparison only. The No Action Alternative consists of refraining from the active application of any remediation technology to sediments in all three sections of Lower Ley Creek. The No Action alternative also excludes source control removal action, administrative actions, and monitoring. As required by CERCLA, periodic reviews would be conducted at 5-year intervals to reassess the long-term appropriateness of continued No Action.

The No Action alternative would not actively reduce the toxicity, mobility, or volume of the contamination through treatment. The cancer risks and non-cancer human health hazards and risks to ecological receptors posed by fish consumption would continue to remain above acceptable levels and the surface water quality would continue to be degraded.

Sediment-2: Removal of Sediment to Cleanup Goals

This alternative includes full excavation of sediments exhibiting concentrations exceeding cleanup goals in all sections of Lower Ley Creek. In the upstream, middle, and downstream sections of Lower Ley Creek, all sediments with concentrations above cleanup goals would be excavated. Excavated sediments would be transported to a centralized sediment dewatering area (SDA) where they would be drained and conditioned for on-site disposal or off-site disposal in a Resource Conservation and Recovery Act (RCRA)-compliant and, if appropriate, a Toxic Substance Control Act (TSCA)-compliant disposal facility. However, on-site disposal may potentially be possible at the Cooper Crouse-Hinds North Landfill or other landfills located adjacent to Lower Ley Creek.

For this FS, it is assumed that excavation in the dry will be done in the shallower areas of Lower Ley Creek (i.e., the upstream section of Lower Ley Creek), while excavation in the wet will be completed in the deeper areas of the creek. After excavation is completed in a particular stream area, approximately 1 ft of clean backfill would be placed to stabilize the sediment bed and support habitat replacement/reconstruction. Backfill configurations would be developed for each excavated section of the creek based on creek conditions such as how fast the creek flows, the type of creek bottom, and habitat goals.

A variety of monitoring activities would be carried out on land and in the creek throughout construction of the alternative, including monitoring of water, sediments, air quality and odor, noise, lighting, and water discharged at the sediment dewatering area. Confirmation sampling would be conducted after the dredging of the sediments has been completed. No long term site management plans or institutional control would be required as part of this alternative.

This alternative significantly reduces the risks to human health and the environment from contaminants at the Site. This conclusion is based on a combination of factors that includes the area remediated, the volume of sediments removed, and the length of creek affected. The sediment excavation alternative is the most extensive remedial alternative, and as such provides the greatest benefits. It serves as the upper bound of the benefits of active remediation of sediments at Lower Ley Creek.

Sediment-3: Granular Material Sediment Cap

This alternative includes the installation of a granular material (sand) sediment cap over portions of the upstream and middle sections of Lower Ley Creek and the excavation of contaminated sediments in portions of the upstream, middle, and downstream sections of Lower Ley Creek. The capping of the areas with sediments exhibiting concentrations exceeding cleanup goals would be completed in a manner that maintains the bathymetry of Lower Ley Creek. Excavated sediments would be transported to a centralized SDA where they would be drained and conditioned for on-site disposal or off-site disposal in a RCRA-compliant and, if appropriate, a TSCA-compliant disposal facility. However, on-site disposal may potentially be possible at the Cooper Crouse-Hinds North Landfill or other landfills located adjacent to Lower Ley Creek.

In areas of the site with low erosion potential (i.e., Old Ley Creek), the granular material sediment cap includes the following design layer:

- Isolation/Habitat Layer (2 ft thick).

In areas of the site with high erosion potential (i.e., Lower Ley Creek), the granular material cap includes the following design layers, from top to bottom:

- Habitat Layer (2 ft thick);
- Armor Layer (0.375 - 2.04 ft thick); and
- Isolation Layer (1.5 - 2 ft thick).

Before the placement of any capping material, excavation of sediment will be conducted to maintain the current bathymetry of Lower Ley Creek. Therefore, in the upstream section of Lower Ley Creek, a 6 ft excavation of sediment would be completed before the sediment cap is installed to maintain the current bathymetry of Lower Ley Creek. Due to this requirement, sediment caps will only be placed in areas exhibiting contamination deeper than 6 ft bgs in the upstream section of Lower Ley Creek. Any areas in the upstream section with contamination less than 6 ft deep will be excavated.

In the middle section of Lower Ley Creek, a 4 ft excavation of sediment would be completed before the sediment cap is installed to maintain the current bathymetry of Lower Ley Creek. Due to this requirement, sediment caps will only be placed in areas exhibiting contamination deeper than 4 ft bgs in the middle section of Lower Ley Creek. Any areas in the middle section with contamination less than 4 ft deep will be excavated.

For this FS, it is assumed that excavation in the dry will be done in the shallower areas of Lower Ley Creek (i.e., the upstream section of Lower Ley Creek), while excavation in the wet will be completed in the deeper areas of the creek.

As part of this alternative, controls would be implemented as part of a site management plan to restrict excavation activities in the capped sediment areas. Controls would consist of a ban on dredging in the capped/backfilled areas, signage, fencing, and ensuring that the current fish advisories for Lower Ley Creek remain in place.

This alternative significantly reduces the risks to human health and the environment from contaminants at the site. This conclusion is based on a combination of factors that includes the area remediated, the volume of sediments removed, and the length of creek affected. This alternative appears to provide a good balance in achieving the RAOs and cleanup goals at costs comparable with Sediment Alternative 4. This alternative significantly reduces the risks to human health and the environment from sediment contamination at the site.

Sediment-4: Engineered Bentonite Sediment Cap

This alternative includes the installation of an engineered bentonite sediment cap over the upstream and middle sections of Lower Ley Creek and the excavation of contaminated sediments in the downstream section of Lower Ley Creek. The capping of the areas with sediments exhibiting concentrations exceeding cleanup goals would be completed in a manner that maintains the bathymetry of Lower Ley Creek. The capping of the sediments in the upstream, and middle sections of Lower Ley Creek would consist of a 2.25 ft excavation and backfill with 3 inches of an engineered bentonite cap beneath 24 inches of a sand layer intended to provide additional bioturbation isolation and benthic restoration capacity. This alternative includes full excavation of sediments exhibiting concentrations exceeding cleanup goals in the downstream section of Lower Ley Creek.

Excavated sediments would be transported to a SDA where they would be drained and conditioned for off-site disposal in a RCRA-compliant and, if appropriate, a TSCA-compliant disposal facility. However, on-site disposal may potentially be possible at the Cooper Crouse-Hinds North Landfill or other landfills located adjacent to Lower Ley Creek.

As part of this alternative, controls would be implemented as part of a site management plan to restrict excavation activities in the capped sediment areas. Controls would consist of a ban on dredging in the capped/backfilled areas, signage, fencing, and ensuring that the current fish advisories for Lower Ley Creek remain in place.

This alternative significantly reduces the risks to human health and the environment from contaminants at the site. This conclusion is based on a combination of factors that includes the area remediated, the volume of sediments removed, and the length of creek affected. This alternative appears to provide a good balance in achieving the RAOs and cleanup goals at costs comparable with Sediment Alternative 3. This alternative significantly reduces the risks to human health and the environment from sediment contamination at the site.

<u>Sediment-5: Monitored Natural Recovery</u>

For this alternative, no active remediation would be undertaken at the Site. Naturally occurring sedimentation and microbially mediated dechlorination and degradation of PCBs – collectively referred to as natural recovery processes – would be relied upon to further reduce risk in the Lower Ley Creek over time.

A 30-year monitoring program would be developed and implemented. Likely components to the program would include periodic monitoring of the water column and fish in Lower Ley Creek. The monitoring program would be reviewed, at a minimum, every 5 years to assess whether modifications were warranted. It is anticipated that fish consumption advisories would remain in place until the New York State Department of Health (NYSDOH) determines the advisories are no longer needed.

ANALYSIS OF REMEDIAL ALTERNATIVES

A detailed evaluation of the soil and sediment remedial alternatives was performed using the following EPA evaluation criteria:

- Protection of Human Health and the Environment;
- Compliance with applicable or relevant and appropriate requirements (ARARs);
- Long-Term Effectiveness and Performance;
- Reduction of Toxicity, Mobility, or Volume;

- Short-Term Effectiveness;
- Implementability; and
- Cost.

Below are the estimated costs for the four soil remedial alternatives and the five sediment remedial alternatives assuming either on-site or off-site disposal of contaminated material:

Soil Remedial Alternatives

Soil Remedial Alternative	Cost (On-site Disposal)	Cost (Off-site Disposal)
Alternative 1 No Action	$ 49,636	$ 49,636
Alternative 2 Excavation of Soil to Meet Cleanup Goals	$ 9,968,720	$ 18,430,403
Alternative 3 Excavation of Southern Swale Soils to Meet Cleanup Goals and Soil Cap for Northwest Soils	$ 9,868,369	$ 18,190,372
Alternative 4 Soil Cap Over All Contaminated Soils	$ 8,643,373	$ 15,825,890

Sediment Remedial Alternatives

Sediment Remedial Alternative	Cost (On-site Disposal)	Cost (Off-site Disposal)
Alternative 1 No Action	$ 49,636	$ 49,636
Alternative 2 Removal of Sediment to Cleanup Goals	$ 7,806,673	$ 16,523,685
Alternative 3 Granular Material Sediment Cap	$ 10,773,004	$ 17,563,198
Alternative 4 Engineered Bentonite Sediment Cap	$ 10,604,482	$ 15,348,472
Alternative 5 Monitored Natural Recovery	$ 1,973,038	$ 1,973,038

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FINAL
FEASIBILITY STUDY REPORT
LOWER LEY CREEK SUBSITE
OF THE ONONDAGA LAKE SUPERFUND SITE
SYRACUSE, NEW YORK

1.0 INTRODUCTION

This Remedial Investigation/Feasibility Study (RI/FS) for Lower Ley Creek Subsite of the Onondaga Lake Superfund Site (the Site) is being performed under U.S. Environmental Protection Agency (EPA) RAC2 Contract Number EP-W-10-007 (Work Assignment Number 007-RICO-024Q) with Los Alamos Technical Associates, Inc. (LATA). HydroGeoLogic, Inc. (HGL) is a Team Subcontractor to LATA on this contract and has the lead technical role for this Work Assignment (WA). The Original WA Form (WAF) for the RI/FS to be performed by LATA for this Site was issued and received on 02 March 2012.

HGL has been tasked by LATA to prepare this Final FS for the Site.

1.1 OBJECTIVES

In accordance with the approved Work Plan dated 15 August 2012, the purpose of this Final FS is to:

- Establish Remedial Action Objectives (RAO).
- Establish General Response Actions.
- Identify and Screen Applicable Remedial Technologies.
- Develop Remedial Alternatives in accordance with the National Contingency Plan (NCP).
- Screen Remedial Alternatives for Effectiveness, Implementability, and Cost.
- Assess each individual alternative against the evaluation criteria.
- Perform a comparative analysis of all options against the evaluation criteria.

1.2 REPORT ORGANIZATION

This Final FS is organized as follows:

- Section 1 – Introduction;
- Section 2 – Site Background;
- Section 3 – Risk Assessment Overview;
- Section 4 – Conceptual Site Model;
- Section 5 – General Scoping of the FS;
- Section 6 – General Response Actions and Applicable Screening Technologies;

- Section 7 – Identification and Screening of Remedial Alternatives;
- Section 8 – Remedial Alternative Evaluation; and
- Section 9 – Comparative Analysis of Remedial Alternatives.

This report also includes the following appendices:

- Appendix A - Summary of Federal and State Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBCs);
- Appendix B - Development of Soil and Sediment Preliminary Remediation Goals (PRGs);
- Appendix C - Remedial Alternative Cost Estimates;
- Appendix D - Site Photographs; and
- Appendix E – Sand and Armor Sediment Capping Details.

2.0 SITE BACKGROUND

2.1 SITE LOCATION AND DESCRIPTION

The Site (CERCLIS ID No. NYD986913580) consists of the lower 2 miles of Lower Ley Creek, beginning at the upstream portion of the Route 11 (a.k.a. Brewerton Road) Bridge and ending downstream at Onondaga Lake (Figure 2.1). The Site also includes the Old Ley Creek Channel, originally a portion of the original Ley Creek prior to its rerouting in the 1970s. The Old Ley Creek Channel is a remnant of Lower Ley Creek adjacent to the Salina Landfill. The Site is a subsite of the Onondaga Lake Superfund Site, which was listed on the National Priorities List (NPL) on 16 December 1994. Lower Ley Creek passes through the Salina Landfill and under the 7th North Street Bridge and Interstate 81 bridges (Figure 2.2). The banks of the stream channel are near vertical in most areas, and the channel is very well defined. The bottom of the stream is dominated by soft sediment with very little stone or other hard surfaces. Much of the stream is shallow, but there are sections where the water depth may be 8-10 feet (ft) deep, particularly downstream of the 7th North Street Bridge. The creek, in general, is narrower and shallower upstream of the 7th North Street Bridge, and wider and deeper downstream of 7th North Street Bridge. The immediate banks of the stream are bordered predominantly by herbaceous vegetation. Some woody shrubs are also mixed in with herbaceous vegetation and sections of the bank are wooded. Beyond the narrow strip of vegetation, the creek is surrounded by manufacturing operations, parking lots, a landfill, and railroad tracks that parallel and are a short distance from much of the southern bank. The creek trends north and then southwest in the last 500 ft before passing under the railroad tracks where it enters Onondaga Lake. The site is located within the urbanized area of Eastern Syracuse, New York. Photographs of the site are included in Appendix D.

2.1.1 Site History

The development of railroads and the Erie Canal System allowed industry and settlement to quickly grow in Eastern Syracuse, New York. Many of these industries were focused around and near Onondaga Lake and included various chemical and pharmaceutical manufacturers among other industries. The industrial nature of this area, as well as the infrastructure and other development, influenced the site and contributed to its current condition.

Assessments have been performed or are currently being performed at a number of potential subsites in the general area to determine whether they contributed to the contamination of Onondaga Lake. The Onondaga Lake Superfund Site includes the lake itself, seven major and other minor tributaries, and various upland sources of contamination. The aerial footprint of the lake is approximately 4.5 square miles.

Prior to the early 1970s, poor channel conditions and large impermeable areas in the watershed caused extensive flooding of Ley Creek. These flooding events led to the formation of the Ley Creek Drainage District and the clearing and dredging of Ley Creek. Dredging of Ley Creek was performed by the Onondaga County Department of Drainage and Sanitation. In 1970, the section of the creek between the 7th North Street Bridge and Route 11 was dredged. In 1971, portions of Ley Creek between the 7th North Street Bridge and Onondaga Lake were dredged. In 1975, Ley Creek was dredged from Townline Road (approximately 1.5 miles north of the Site) to

Onondaga Lake. In 1983, a section of Ley Creek north of the Site (Townline Road to Route 11) was dredged. Dredged material (i.e., spoils) generated during these dredging activities was placed along the banks of Ley Creek. Prior to this dredging of the creek discussed above, Ley Creek did not flow through the Salina Landfill.

There are several properties that are known to be either contributors or potential contributors of contaminants to Ley Creek. These include: the General Motors (GM) Former Inland Fisher Guide (IFG) Facility and Ley Creek Deferred Media Site; the GM Ley Creek Polychlorinated Biphenyls (PCB) Dredgings Site; and the Town of Salina Landfill, which surrounds Lower Ley Creek just downstream of Route 11/Brewerton Road. The GM-IFG Facility, the Ley Creek Deferred Media Site, and the GM Ley Creek PCB Dredgings Site are located upstream of this Site.

The Town of Salina Landfill is shown in Figure 2.2. A Record of Decision (ROD) for the Salina Landfill was signed in 2007. The ROD included plans for the installation of a 6 New York Codes, Rules and Regulations (NYCRR) Part 360 cap, installation of storm water collection and drainage improvements, and installation of a groundwater/leachate collection trench to the north and south of Lower Ley Creek. An amended ROD for the Town of Salina Landfill was issued in September 2010 and included the consolidation of the landfill and excavation of the 5 acre portion of the south side of Ley Creek. The remedial activities began in 2011 and are expected to be completed in 2013.

2.1.2 Site Physical Characteristics

The following discussion of the physical characteristic of the Site is taken from the Lockheed Martin Scientific, Engineering, and Analytical Services (SERAS) *Field Activities Summary Report, Lower Ley Creek Superfund Site* (SERAS, 2012) and the Old Ley Creek Final Remedial Investigation Report (EA Science and Technology [EA], 2010).

2.1.2.1 Surface Features

Ley Creek flows through urban developed East Syracuse. Along the 2 miles of Lower Ley Creek (the Site), the creek flows through a landfill, under several bridges, along a railroad track, adjacent to several businesses, and near a major shopping mall. The bed of the creek is well channeled with steep sides, and the creek depth ranges from 1-14 ft. However, the creek is relatively shallow in most locations, ranging from only 3-5 ft deep over much of its length. The location of the original streambed has been altered by human activity, particularly where it flows through the Town of Salina Landfill. In addition, the channel was widened and altered by man before 1980 to address channel conditions causing extensive flooding. The bottom of the stream is mostly composed of soft sediment, with very little areas of stone or riffle.

The topography at Old Ley Creek is irregular having been modified through re-routing of the channel and dumping of waste along the banks of the old channel. Old Ley Creek was formerly a wetland complex that extended from the northeastern shore of Onondaga Lake to just south of the village of Mattydale. The extreme northern portion of this wetland complex was used as the Town of Salina Landfill. Landfilling operations appear to have encroached to the banks of the Old Ley Creek Channel. The U.S. Fish and Wildlife Service has also mapped a wetland that encompasses the Old Ley Creek Channel site from the edge of the Town of Salina Landfill parcel to a point just east of State Route 11 (see Figure 2.3).

2.1.2.2 Land Use

The land surrounding Lower Ley Creek is mostly used for industrial purposes. The surrounding area has been urbanized for many decades and contains numerous industries, a landfill, roads, businesses, homes, and other infrastructure. However, some ecologically sensitive areas are directly adjacent to Lower Ley Creek.

The creek itself is not used commercially, although it is easily accessible for fishing and other recreation. Access to this site is unrestricted, and the property is adjacent to a public thoroughfare. However, site access is difficult due to thick vegetation. Flow in the channel does not support an attractive fishery, making trespassing and direct contact with contaminated materials unlikely. There are currently fish advisories in place for Onondaga Lake and its tributaries which includes Ley Creek. There does not seem to be any other controls (i.e., fencing, signage) currently in place for the Site.

The Old Ley Creek Channel is the former channel for Ley Creek. Ley Creek was rerouted in the early-1970s, turning the channel into a tributary for the new channel. The Old Ley Creek Channel has been used as a disposal area for miscellaneous materials (i.e., tires, scrap metal, furniture). The sources of this material are unknown. The Old Ley Creek Channel property is currently owned by Plaza East. The parcel is approximately 3.5-acres and is zoned as commercial.

2.1.2.3 Climate

The climate around the Site is temperate continental. Due to Lake Ontario, the weather patterns in the area yield a more moderated air temperature relative to other areas at the same latitude. The mean annual temperature is 50.6 degrees Fahrenheit (°F), with an average maximum daily temperature of 59.8°F and an average daily minimum temperature of 41.4°F (National Oceanic and Atmospheric Administration [NOAA], 2011). Record temperatures range from 101°F in the summer months to -26°F in the midwinter months. The average first occurrence of freezing temperatures in the fall is around November 15, and the average last occurrence of freezing temperatures in the spring is April 8. Moisture enters the area primarily via low-pressure systems that move through the St. Lawrence Valley toward the Atlantic Ocean. Yearly precipitation averages approximately 48 inches and is distributed fairly evenly throughout the year. Syracuse area winds are predominantly from the west and northwest.

2.1.2.4 Geology

The bedrock geology in the area of Lower Ley Creek consists of sedimentary rock units from the Paleozoic-age Salina Group, which, in order of oldest to youngest, consists of the Vernon Formation, the Syracuse Formation, Camillus Shale, and the Bertie Formation. The Vernon Formation, consisting of red and green shale, underlies Onondaga Lake and is the thickest single formation in Onondaga County. This layer consists of approximately 500 to 600 ft of grey, red, and green mudstones that are relatively soft and erodible interspersed with gypsum seams. Most of this layer is fairly impermeable. In areas to the south of Onondaga Lake, the Syracuse Formation overlies the Vernon Formation. The Syracuse Formation varies from approximately 150 to 220 ft thick and consists of shale, gypsum, and rock salt. Groundwater flows to the north toward Onondaga Lake and is the source of naturally occurring brines in the area. The unconsolidated deposits overlying the bedrock around Onondaga Lake vary in thickness, with much of the lake underlain by approximately 100 ft of deposits, which thicken to approximately 328 ft at the mouth of Onondaga Creek at the southern end of the lake. Most of these deposits are glacial in origin but quite variable in size and origin. Naturally occurring materials found at the surface may include the glacial deposits, or deposits of more recent origin such as clay, peat, and marl formed in and at the edges of the lake. The area around the lake is mostly fill material and other debris. The glacial deposits found beneath the lake also extend beyond the lake margins and fill the major drainage channels leading into and out of the lake. Deposits within these channels are primarily outwash in origin and consist of sand and gravel, with an interbedded fine component. These outwash deposits are locally heterogeneous and receive recharge from upland areas from both groundwater and surface water flow. Organically rich sediments occur in much of the southern portion of the lake.

2.1.2.5 Soils

The surface soils surrounding Onondaga Lake consist of glacial origin deposits including till, outwash, alluvial, and glacio-lacustrine sediments. Above the unconsolidated sediments in many upland areas near the site are fill deposits composed of peat, cinders, ash, and other wastes. Significant amounts of soil erode into the streams surrounding the lake during heavy storms. Human activity has altered the natural soil surrounding most of the lake and most of the original soils are no longer found.

2.1.2.6 Surface-Water Hydrology

Onondaga Lake receives surface runoff from a drainage basin of approximately 250 square miles. Surface water flows into the lake via six tributaries: Ninemile Creek, Onondaga Creek, Ley Creek, Harbor Brook, Bloody Brook, and Sawmill Creek. A small amount of additional water is added to the lake through two industrial conveyances. Ninemile and Onondaga Creeks account for most of the inflow to the lake, together comprising approximately 62 percent (%) of the total inflow for the period from 1971 to 1989. Ley Creek accounts for approximately 8% of the total water inflow to the lake.

Water flows westerly in Lower Ley Creek towards Lake Onondaga. The movement of water within the stream is generally consistent. There are no areas of rock or riffle, although flow increases after storm events. The 100-year floodplain and wetland areas adjacent to Lower Ley Creek are shown in Figure 2.3.

2.1.2.7 Hydrogeology

Groundwater discharge to surface channels accounts for most of the stream flow in the Onondaga Lake Basin. Groundwater discharge accounts for 56% of stream flow in Ley Creek.

Based on well logs available from drilling conducted in support of the Town of Salina Landfill, overburden in the vicinity of the Old Ley Creek Channel consists of waste/fill, clay, silt, and silty clay at the surface with a combination of sand, gravel, and till at depth. Groundwater in the overburden is from 8 to 12 ft below ground surface (bgs). Evaluations of groundwater flow patterns indicate that groundwater flow is moving radially toward Ley Creek to the north and west of Old Ley Creek.

2.1.2.8 Ecology

Historically, Onondaga Lake was a moderately productive mesotrophic lake with some dissolved nutrients and fresh to slightly brackish water. Water in the lake is greenish, as is typical of mesotrophic lakes, likely a result of high concentrations of algae. There is evidence of a much more diverse and different fish community in and around Onondaga Lake in the past (SERAS, 2012). Historical fish surveys indicate a population consisting of approximately 90% carp and described Onondaga Lake as a warm-water fish community with similar growth rates as other warm-water lakes in the northeastern United States (SERAS, 2012).

In the vicinity of the lake, Ley Creek likely supports a fish community similar to the other large tributaries. Fish sampling has been performed as part of investigative activities associated with GM’s Former IFG Facility located approximately 3.5 miles upstream of the lake (1.5 miles upstream of the Site). The primary fish species observed as part of those investigations, conducted in 1985 and 1992, included bluegill, pumpkinseed, shiners, bullhead and carp.

In November 2009, fish sampling in Lower Ley Creek was performed as part of the EPA SERAS/Environmental Response Team (ERT) Investigation. The fish caught included several very large (3 to 6 pound) carp, many smaller carp, sunfish, white suckers, creek chubs, pike, one brown trout, and an assortment of small “minnow” types and miscellaneous young fish.

2.1.2.9 New York State Wetland SYW-12

New York State (NYS) Wetland SYW-12, also known as Murphy’s Island, is an abandoned 36 acre lot along the southeastern shoreline of Onondaga Lake that is a culturally important area to the Onondaga Nation. All the remediation alternatives in this Draft FS have controls in place that will ensure that Murphy’s Island will not be affected by any remediation activities.

2.2 PREVIOUS SITE ACTIVITIES AND INVESTIGATIONS

2.2.1 Lower Ley Creek Investigations

The NYS Department of Environmental Conservation (NYSDEC) and the Onondaga County Department of Health collected three soil samples adjacent to the north bank of Ley Creek along the Salina Landfill and four surface water samples from the same stretch of Ley Creek and drainage ditches north and east of the landfill in 1986. PCBs were detected in the soil samples collected adjacent to Ley Creek. In 1987, NUS Corporation collected five soil samples from the main fill area north of Ley Creek, and three surface water and three sediment samples from Ley Creek. These samples consisted of one surface water and one sediment sample from an upstream location in Ley Creek (west of Route 11), one surface water and one sediment sample alongside the landfill, and one surface water and one sediment sample just downstream of the landfill in Ley Creek. The soil samples contained polyaromatic hydrocarbon compounds (PAH), metals, volatile organic compounds (VOC) and pesticides in low levels, but no PCBs. In general, surface water and sediment samples collected downstream from the landfill did not contain higher concentrations of contaminants than the samples collected upstream of the landfill.

Limited NYSDEC sampling in 1987 and 1997 indicated the presence of PCBs at hazardous waste levels in both the former channel sediments and subsurface soils. In addition, the 1997 former channel sediment sampling showed levels of heavy metals exceeding the NYSDEC Fish & Wildlife Severe Effect Levels (SEL). Ley Creek channel sediments were sampled in 1998 as part of the Salina Landfill RI/FS, and were found to contain levels of PCBs at greater than 80 parts per million (ppm), chromium at levels greater than 1,700 ppm, and other heavy metals exceeding their respective SELs.

2.2.1.1 Old Ley Creek Channel Investigation

In 2010, the NYSDEC tasked EA Engineering, P.C., and its affiliate EA, to perform a RI at the Old Ley Creek Channel (EA, 2010). The Old Ley Creek Channel is located west of the intersection of Factory Avenue and Wolf Street (State Route 11) in the town of Salina, Onondaga County, New York. The approximately 3.5-acre site is within an overgrown and wooded area adjacent to the banks of the Old Ley Creek Channel between Route 11 and Ley Creek (Figure 2.2).

The Old Ley Creek Channel is approximately 1,350 ft in length and flows from northeast to southwest draining to Ley Creek. The Town of Salina Landfill is located west and northwest of the Old Ley Creek Channel. The landfill began operations in the 1950s and active land filling operations ceased in 1974-1975. During its operation, the landfill received domestic, commercial, and industrial wastes. Hazardous waste, including 640 tons of paint sludge, and 22 tons of waste paint thinner and reducer from GM's IFG Division were disposed of at the landfill. Closure via a soil cover cap was completed in 1982. During the early 1970s, in an effort to limit flooding in the area, the U.S. Army Corps of Engineers (USACE) re-routed Ley Creek through the landfill area (NYSDEC, 2009a). The re-routing of the creek adjacent to Route 11 separated a fragment of the landfill between the new course of Ley Creek and the Old Ley Creek Channel.

The analytical results of the Old Ley Creek Channel RI exhibited:

- VOCs, semi-volatile organic compounds (SVOC), metals, pesticides, and PCBs were detected in groundwater but exhibited limited impact. Some metals were detected at concentrations greater than their respective NYSDEC Water Quality Standards.
- Metals, pesticides, and PCBs were present in surface water during two of the sampling rounds at concentrations greater than their respective NYSDEC Water Quality Standards.
- SVOCs, pesticides, PCBs, and metals were present in soils above NYSDEC unrestricted use soil criteria from the surface to several ft below grade with the highest concentrations being within the first 2 ft. Only limited low-level impacts to soils by VOCs were identified.

- VOCs, SVOCs, pesticides, PCBs, and metals were present in sediment above NYSDEC sediment criteria from the surface to 2 ft below grade.

Based on the results of the RI, several factors have resulted in impacts to environmental media at the Old Ley Creek Channel. Historical land-filling activities from the 1950s through the 1970s at the Town of Salina Landfill are one of the potential sources of impacts to the area. Soil, groundwater, surface water, and sediment have been impacted by PCBs, heavy metals, and organic compounds. The analytical results collected during completion of the RI also confirmed that soil, surface water, groundwater, and sediment have been impacted by the migration of contaminants to the site from upstream sources, specifically from the flow of Ley Creek.

2.2.2 Current Activities at the Former Town of Salina Landfill

During a site visit in October 2012, the former Town of Salina Landfill was in the process of being capped. Work was being led by Clough, Harbour & Associates (CHA) under the direction of the NYSDEC. The entire section of the landfill south of Lower Ley Creek with PCBs less than 50 ppm was relocated north of Lower Ley Creek in 2011. Material with 50 ppm PCBs or greater was properly disposed of in an off-site Toxic Substances Control Act (TSCA) landfill. Except for a 50-ft section in the southeast corner of the relocation effort, this landfill excavation did not intersect with Lower Ley Creek or the Old Ley Creek Channel. The 50-ft section that did intersect with Lower Ley Creek and/or the Old Ley Creek Channel contained soils and sediment with PCB concentrations less than 50 ppm and are capped under the completed section of the Town of Salina Landfill closure system.

PCB contaminated soil with concentrations greater than 50 ppm and up to 333 ppm were excavated and shipped off-site to a TSCA landfill. Soils with less than 50 ppm PCBs were placed on the north side of Lower Ley Creek on the Town of Salina Landfill, and were capped in 2012. Generally speaking, PCB-contaminated material with concentrations greater than 1 ppm was removed from the 4 acres south of Ley Creek during the consolidation effort.

2.3 NATURE AND EXTENT OF CONTAMINATION

This section discusses the results of the EPA SERAS/ERT Investigation of Lower Ley Creek and the results of the Old Ley Creek Channel RI performed by EA.

2.3.1 Lower Ley Creek

During the most recent investigation at Lower Ley Creek (SERAS, 2012), EPA SERAS-ERT collected fish tissue samples, surface water samples, soil samples, and sediment samples to characterize the nature and extent of contamination at the Site.

To assist with the determination of remedial alternatives for soil, site soils have been separated into two areas (Southern Swale Soils and Northwest Soils). These two areas are shown on Figure 2.4. This separation was made because there are specific remedial challenges associated with each area. While the Northwest Soil area has two large buried pipelines to consider, remediation of the Southern Swale Soil area may require limited wetland restoration.

To assist with the determination of remedial alternatives for sediment, the 2-mile stretch of the Lower Ley Creek Subsite has been separated into three sections (upstream, middle, and downstream). These three sections are shown on Figure 2.5. This separation was made because the downstream section of the Site exhibits lower concentrations of contaminants and a smaller extent of contamination than the upstream or middle sections of the Site. In addition, the upstream and middle sections of the site exhibit distinctive stream characteristics. While the upstream section of Lower Ley Creek meanders, the middle section of the creek is relatively straight. The upstream portion of Lower Ley Creek extends from upstream of the Route 11 Bridge to its intersection with the 7th North Street Bridge. The upstream section also includes sediments associated with the Old Ley Creek Channel. The middle section of Lower Ley Creek extends from its intersection with the 7th North Street Bridge to approximately 2,000 ft southwest of the intersection (near the Alliance Bank Stadium). The downstream section of Lower Ley Creek extends from approximately 2,000 ft southwest of the 7th North Street Bridge intersection to its discharge into Onondaga Lake.

2.3.1.1 Fish Tissue

The fish tissue samples exhibited detectable concentrations of metals, organic compounds, PCBs, and dioxins/furans. Ecological risks exist from concentrations of dioxins and PCBs in the fish tissue. In addition, human health risks exist from the potential consumption of contaminated fish from Lower Ley Creek. The primary human health risk drivers in the fish tissue are PCBs, arsenic, and mercury.

2.3.1.2 Surface Water

The surface water samples exhibited detections of metals, VOCs, and base/neutral/acid organic compounds (BNA). No metals or VOCs were detected above NYSDEC Water Quality Standards. BNAs were detected at or above their respective NYSDEC Water Quality Standards at several surface water sample locations.

PCBs were not detected in surface water collected during this investigation. However, surface water sample results associated with baseline monitoring program for the Lake Bottom Subsite of the Onondaga Lake Superfund Site collected in 2011 (samples collected by Honeywell) exhibited PCB concentrations ranging from 0.048 to 0.23 micrograms per liter (µg/L), which is above the NYSDEC Water Quality PCB Standard of 0.09 µg/L when used as a human water source. For human fish consumption, 1×10^{-6} µg/L is the NYSDEC Water Quality PCB Standard.

2.3.1.3 Sediments

Sediment samples were collected along the entire 2-mile length of the Lower Ley Creek Site. Pesticides, metals, cyanide, PCBs, VOCs, BNAs, and dioxins/furans were detected in the sediment samples. Pesticides, metals, mercury, PCBs, VOCs, and BNAs were detected above their respective unrestricted use NYS sediment criteria. Cyanide and all the dioxins/furans detected in sediment samples have no NYS sediment criteria for comparison. However, some dioxins/furans in sediment were detected above the EPA preliminary remediation goal for dioxins in residential soil.

The cross sections locations for Old Ley Creek and Lower Ley Creek are shown in Figure 2.6. Cross Sections for Old Ley Creek are shown in Figures 2.7 and 2.8. Figures 2.9 to 2.12 exhibit cross sections for the Northern Upstream Section (Figure 2.9), Southern Upstream Section (Figure 2.10), Middle Section (2.11), and Downstream Section (Figure 2.12) of Lower Ley Creek. Each cross section presents the maximum concentrations in sediments by sample location for PCBs, mercury, benzo(a)pyrene, and total chromium.

In sediment, metals (particularly cadmium, chromium, and nickel), BNAs, PCBs, and some pesticides may be an ecological risk to aquatic plants and benthic invertebrates. The primary human health risk drivers in sediment are BNAs. Specific BNA human health drivers include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h) anthracene, and indeno(1,2,3-cd)pyrene.

The highest metal concentrations in sediment appear to be in the middle and upstream portions of Lower Ley Creek, with decreasing concentrations towards Onondaga Lake. The highest BNA, PCB, and pesticide concentrations in sediment also appear to be in the middle and upstream portions of Lower Ley Creek, with decreasing concentrations towards Onondaga Lake.

2.3.1.4 Soils

Soil samples were collected along the banks and dredged spoils areas adjacent to Lower Ley Creek. Soil samples exhibited detections of pesticides, metals, cyanide, PCBs, VOCs, BNAs, and dioxins/furans. Pesticides, metals, mercury, PCBs, VOCs, and BNAs were detected above their respective unrestricted use NYS soil criteria. Although the dioxins/furans detected in soil do not have NYS soil criteria for comparison, some dioxins/furan analytical results were above the EPA PRG for dioxins in residential soil. Figures 2.13 to 2.24 present the maximum concentrations in soil by sample location for major contaminant drivers in three general depth intervals (surface soil, shallow subsurface soil, and deep subsurface soil). Major contaminant drivers include: PCBs (Figures 2.13 to 2.15), mercury (Figures 2.16 to 2.18), benzo(a)pyrene (Figures 2.19 to 2.21), and total chromium (Figures 2.22 to 2.24).

The primary human health risk drivers in soils are PCBs, BNAs, and total chromium. The highest PCB concentrations in soil appear to be associated with swale sampling, which was conducted just south of where Old Ley Creek enters Lower Ley Creek. Elevated PCB concentrations were also found in areas where spoils associated with the dredging of Lower Ley Creek were reportedly deposited, especially on the south side of Lower Ley Creek just north of its intersection with the 7th North Street Bridge. The highest BNA concentrations in soil appear to be associated with spoils associated with the dredging of Lower Ley Creek, especially on the west side of Lower Ley Creek just north its intersection with I-81. The highest total chromium concentrations in soil appear to be found in areas where spoils associated with the dredging of Lower Ley Creek were reportedly deposited, especially on the north and south side of Lower Ley Creek just north of its intersection with the 7th North Street Bridge.

The ecological risks associated with soil contamination were not evaluated as part of the baseline ecological risk assessment (BERA) prepared by EPA SERAS-ERT in 2012. However, the soil PRGs developed in this FS are protective of ecological receptors.

2.3.1.5 Summary

The major areas of contamination in soil are present where spoils associated with the dredging of Lower Ley Creek were reportedly deposited, especially on the north and south side of Lower Ley Creek just north of its intersection with the 7th North Street Bridge. Soil contamination extends from the surface to as deep as 14 ft bgs. The major areas of contamination in sediment are in the upstream and middle portions of Lower Ley Creek, with decreasing concentrations towards Onondaga Lake. Sediment contamination extends from the surface to as deep as 8 ft below the water-sediment interface (bwsi). The contamination in the sediment is likely influencing the contamination also present in fish tissue and surface water samples.

2.3.2 Old Ley Creek Channel

This section briefly discusses the results of the Old Ley Creek Channel RI.

2.3.2.1 Soil Investigation

The subsurface and surface soil analytical results indicate that soil at the site is impacted by SVOCs, pesticides, PCBs, and metals. Only limited low-level impacts to soils by VOCs were identified. PCB impacts are the most wide spread in both areal and vertical extents.

2.3.2.2 Sediment Investigation

The sediment analytical results indicate that sediment at the site is impacted by VOCs, SVOCs, pesticides, PCBs, and metals. With the exception of vinyl chloride concentrations greater than Human Health criteria at SED-03, only limited low-level impacts to sediment by VOCs were identified. PCB and pesticide impacts are the most wide-spread in both areal and vertical extents.

2.3.2.3 Groundwater Investigation

The groundwater analytical results indicate that concentrations of the metals antimony, iron, magnesium, manganese, selenium, and sodium were detected at concentrations greater than their respective NYSDEC Water Quality Standards. Analysis of groundwater at the site indicates that there are no impacts from VOCs, SVOCs, pesticides, or PCBs.

2.3.2.4 Surface Water Investigation

The surface water analytical results indicate that metals, pesticides, and PCBs were detected at concentrations greater than their respective NYSDEC Water Quality Standards. Analysis of surface water at the site indicates that there are no impacts from VOCs or SVOCs.

3.0 RISK ASSESSMENT OVERVIEW

A risk assessment is an evaluation of risk to human and ecological receptors posed by the presence of chemicals at a site if no remedial action is performed. A summary of the human health risk assessment (HHRA) and the BERA is provided in this section. The HHRA and BERA were completed in 2012 as part of the EPA SERAS-ERT *Field Activities Summary Report, Lower Ley Creek Superfund Site* (SERAS, 2012). The objectives of these risk assessments are to characterize the potential risks associated with exposure to site media.

3.1 HUMAN HEALTH RISK ASSESSMENT

The 2012 HHRA was conducted to evaluate whether chemical concentrations detected in media at the site pose a significant threat to human health. Chemical concentrations in fish tissue, surface water, soil, and sediment were screened using the appropriate screening values to select chemicals of potential concern (COPC) for the HHRA.

3.1.1 Selection of Chemicals of Potential Concern

COPCs were identified based on a screening analysis that uses the EPA regional screening levels (RSL) (EPA, 2009). Chemicals are selected as COPCs if their maximum detected concentration in a given medium (sediment, surface water, fish) is greater than the relevant RSL and their detection frequency is greater than 5%. In addition, all chemicals classified as category A – known human carcinogens – are selected as COPCs.

3.1.2 Exposure Pathways

Recreational users (both adults and children) and future construction workers are the primary receptor groups evaluated in the HHRA. Potential exposure pathways include contact with Lower Ley Creek sediments and surface water via incidental ingestion and dermal contact, as well as potential consumption of contaminated fish and wildlife.

3.1.3 Non-Cancer Summary

For non-cancer effects, an initial estimate of the total non-cancer risk is derived simply by summing the hazard values across all chemicals to calculate a hazard index (HI). If the HI is less than 1, non-cancer risks are not considered to be significant. If the HI is greater than 1, then it may be appropriate to examine individual chemical hazards and determine their risks and their effect on the same target tissue or organ system.

3.1.3.1 <u>Recreational Visitor – Adult</u>

3.1.3.1.1 Sediments

The total HI for the adult recreational visitor exposure is above 1 for both the reasonable maximum exposure (RME) and central tendency exposure (CTE) scenarios, with HI values of 32 and 10, respectively. The exceedances are primarily due to exposures via fish ingestion, with Aroclor-1254 as the primary risk driver and to a lesser extent Aroclor-1260 and total chromium.

3.1.3.1.2 Soils

The total HI for the adult recreational visitor is equal to 1 for the RME scenario and less than 1 for the CTE scenario, with an HI value of 0.4.

3.1.3.2 Recreational Visitor – Older Child (6 - <16 years old)

3.1.3.2.1 Sediments

The total HI for the older child recreational visitor is above 1 for both the RME and CTE scenarios, with HI values of 32 and 8, respectively. The exceedances are primarily due to exposures via fish ingestion and to a lesser extent via dermal exposure to sediment in Lower Ley Creek. Risk from ingestion of fish tissue is primarily driven by Aroclor-1254 and to a lesser extent Aroclor-1260 and total chromium. Risk from dermal exposure to sediment in Lower Ley Creek is primarily driven by Aroclor-1260.

3.1.3.2.2 Soils

The total HI for the older child recreational visitor is greater than 1 for the RME scenario, with an HI value of 11. The HI value for the CTE older child recreational visitor is 0.5. Dermal exposure to Aroclor-1248 is the primary risk driver contributing to the exceedance for the RME receptor.

3.1.3.3 Recreational Visitor – Younger Child (<6 years old)

3.1.3.3.1 Sediments

The total HI for the younger child recreational visitor is above 1 for both the RME and CTE scenarios, with HI values of 65 and 18, respectively. The pathway that contributes the greatest hazard is fish ingestion, although direct contact (ingestion and dermal) with sediment in Lower Ley Creek or in the Dredge Spoils area also contributes to an HI greater than 1 for the RME scenario. Risk from ingestion of fish is primarily driven by Aroclor-1254, Aroclor-1260, and total chromium, and to a lesser extent arsenic and mercury. Risks from direct contact exposure to sediment are primarily driven by Aroclor-1260 or Aroclor-1248.

3.1.3.3.2 Soils

The total HI for the younger child recreational visitor is greater than 1 for both the RME and CTE scenarios, with HI values of 24 and 2, respectively. For the RME scenario, the exceedance is primarily due to direct contact (ingestion and dermal contact) with Aroclor-1248 in the soil. For the CTE scenario, the exceedance is primarily due to exposure via ingestion of soil, with Aroclor-1248 as the primary risk driver and to a lesser extent total chromium and cadmium.

3.1.3.4 Construction Worker – Adult

3.1.3.4.1 Sediments

The total HI for the adult construction worker is below 1 for both the RME and CTE scenarios.

3.1.3.4.2 Soils

The total HI for the adult construction worker is greater than 1 for both the RME and CTE scenarios, with HI values of 7 and 2, respectively. The exceedances are primary due to direct contact (ingestion and dermal contact) with Aroclor-1248 in soil.

3.1.4 Cancer Risk Summary

Cancer risks are expressed as the increased risk of developing cancer as a result of a given exposure to a given chemical. These "excess" cancer risks are summed across all carcinogenic chemicals and all exposure pathways for each receptor category. In general, EPA considers excess cancer risks less than 1 in 1 million (expressed as 1E-06) to be so small as to be negligible, and risks above 1E-04 to be sufficiently large that some action may be necessary. Excess cancer risks between 1E-04 and 1E-06 are generally evaluated on a case-by-case basis, and EPA may determine that risks in this range warrant remedial action.

3.1.4.1 Recreational Visitor – Adult

3.1.4.1.1 Sediments

The total cancer risk for the adult recreational visitor is 4E-04 for the CTE scenario and 4E-03 for the RME scenario. The primary risk driver is ingestion of fish tissue, with PCBs, total chromium, and arsenic contributing the greatest to total risk.

3.1.4.1.2 Soils

The total cancer risk for the adult recreational visitor is 1E-05 for the CTE scenario and 1E-04 for the RME scenario. The primary risk drivers are total chromium via ingestion and benzo(a)pyrene via dermal exposure to soil.

3.1.4.2 Recreational Visitor – Older Child (6 - <16 years old)

3.1.4.2.1 Sediments

The total cancer risk for the older child recreational visitor is 3E-04 for the CTE scenario and 1E-03 for the RME scenario. The primary risk drivers are PCBs, total chromium, and arsenic via fish ingestion and benzo(a)pyrene via sediment exposure.

3.1.4.2.2 Soils

The total cancer risk for the older child recreational visitor is 3E-05 for the CTE scenario and 8E-04 for the RME scenario. The primary risk driver is benzo(a)pyrene via dermal exposure to soil.

3.1.4.3 Recreational Visitor – Younger Child (<6 years old)

3.1.4.3.1 Sediments

The total cancer risks for the younger child recreational visitor are 5E-04 and 2E-03 for the RME and CTE scenarios, respectively. Risk drivers include PCBs, total chromium, and arsenic in fish tissue; and PAHs (e.g., benzo(a)pyrene) in sediments.

3.1.4.3.2 Soils

The total cancer risk for the young child recreational visitor is 1E-04 for the CTE scenario and 2E-03 for the RME scenario. The primary risk driver is benzo(a)pyrene via ingestion and dermal exposures to soil, and to a lesser extent dibenzo(a,h)anthracene via dermal exposure. Additional risk drivers in soil are PCBs and total chromium.

3.1.4.4 Construction Worker – Adult

3.1.4.4.1 Sediments

The total cancer risk for the adult construction worker is 2E-06 and 8E-06 for the RME and CTE scenarios, respectively.

3.1.4.4.2 Soils

The total cancer risk for the adult construction worker is 1E-05 for the CTE scenario and 4E-05 for the RME scenario. The primary risk driver is total chromium via ingestion of soil.

3.1.5 Sediments and Soils Exposure Risks

Table 3.1 and Figure 3.1 summarize the human health risks associated with exposure to sediments and soil in Lower Ley Creek. It is likely that recreational visitors to the site may be exposed to both creek sediments and upland soils. Exposure to only soils or only sediments results in cancer risk estimates above 1E-04 for the RME older child and the RME young child, and non-cancer HI estimates greater than 1 for the RME older child and both the CTE and RME young child. These exceedances remain consistent for all of the combined soil/sediment exposure percentages.

3.2 BASELINE ECOLOGICAL RISK ASSESSMENT

Five assessment endpoints (AE) were selected to evaluate risk to ecological receptors at the Site:

1. Survival;
2. Growth and Reproduction of Aquatic Plants;

3. Benthic Invertebrates;
4. Fish; and
5. Piscivorous Birds and Mammals.

As part of the BERA conducted in 2012, a screening level ecological risk assessment (SLERA) compared measured concentrations in abiotic media to conservative screening benchmarks. The measured (maximum detected) concentration of several inorganics in surface water, and numerous COPCs measured in surface sediment samples, exceeded their screening benchmarks, indicating the potential for adverse effects to the aquatic community in Lower Ley Creek.

For the BERA, measured concentrations of selected COPCs in fish tissue were compared with concentrations reported in the literature that are associated with adverse effects in fish. Dietary exposure of piscivorous birds and mammals feeding on prey captured from Lower Ley Creek was also evaluated. Solid-phase toxicity tests were conducted using two invertebrate species. Risk to the aquatic plant community in Lower Ley Creek was assessed by comparing measured concentrations of COPCs in surface water with selected surface water quality benchmarks and by comparing measured concentrations of COPCs in sediment with soil benchmarks for plants.

Exceedances of surface water quality benchmarks and sediment benchmarks suggest potential risk to aquatic plants, benthic invertebrates, and fish. In sediment, inorganics (particularly cadmium, total chromium, and nickel), PAHs, PCBs, and some pesticides resulted in exceedances of screening values, indicating potential risk to aquatic plants and benthic invertebrates.

Reduced growth was observed in invertebrates exposed to sediment samples collected from several locations in Lower Ley Creek; significant mortality was observed in one sample. No significant correlations with measured COPC concentrations in sediment samples were observed within the test results.

Total equivalent concentrations (TEC) of dioxin in fish tissue collected from Lower Ley Creek exceeded concentrations reported to be associated with adverse effects in fish.

Piscivorous mammals are at risk from dietary exposure to measured total PCB concentrations in fish from Lower Ley Creek. It may also be concluded that piscivorous birds are at risk from dietary exposure to PAHs and potentially total chromium.

The following inorganics were retained as COPCs potentially resulting in direct toxicity to benthic invertebrates: arsenic, cadmium, total chromium, copper, lead, mercury, nickel, silver, and zinc. The maximum no-effect concentration observed in the toxicity tests was identified as the PRG:

- Arsenic, 5.6 milligrams per kilogram (mg/kg);
- Cadmium, 6.4 mg/kg;
- Total Chromium, 94.2 mg/kg;
- Copper, 102 mg/kg;

- Lead, 87.8 mg/kg;
- Mercury, 0.29 mg/kg;
- Nickel, 34.4 mg/kg;
- Silver, 2.1 mg/kg; and
- Zinc, 342 mg/kg.

Site-specific bioaccumulation factors for PCBs were calculated for forage fish in the upper, middle and lower sections of Lower Ley Creek. Lowest observed adverse effect level (LOAEL)-based and no observed adverse effect level (NOAEL)-based sediment concentrations were calculated to identify a range of sediment PCB concentrations below which adverse effects on wildlife receptors would not be expected. Sediment concentrations that would result in calculated hazard quotients (HQ) less than 1.0 for mink (the most sensitive receptor at this site based on the food chain models) were calculated. The LOAEL-based sediment PCB concentrations protective of ecological receptors ranged from 0.08 to 2.28 mg/kg. The NOAEL-based sediment PCB concentrations protective of ecological receptors ranged from 0.01 to 0.23 mg/kg.

Based upon the results, risk characterization, and interpretation, ecological risks exist at the Site from contaminants in sediments. These contaminants include PAHs and several inorganics, which may pose a risk via exposure to surface water in addition to exposure to sediment. Ecological risk exists from concentrations of dioxin-like COPCs in fish tissue, and PCB concentrations in sediment and forage fish pose a risk to piscivorous mammals. A conceptual site model for ecological risks is exhibited in Figure 3.2.

The ecological risks associated with soil contamination were not evaluated as part of the BERA prepared by EPA SERAS-ERT in 2012. However, the soil PRGs developed in this FS are protective of ecological receptors (Appendix B).

4.0 CONCEPTUAL SITE MODEL

In order to better develop and evaluate remedial alternatives, a conceptual site model (CSM) was developed as part of this Draft FS. This CSM identifies the processes and interactions that typically control the transport and fate of contaminants. Exposure pathways for humans and biota and human and ecological receptors have been presented and discussed in Section 3.0. Therefore, this CSM includes an evaluation of the following:

- Sources of Contaminants of Concern;
- Contaminant Transport Pathways; and
- Hydrologic Evaluation.

4.1 CONTAMINANT SOURCES AND TRANSPORT

4.1.1 Sediment Contamination

The initial source of the majority of contamination in Lower Ley Creek was likely the GM-IFG Facility located upstream of Lower Ley Creek. Contaminants from this site have adhered to the sediments in Lower Ley Creek and these sediments now serve as a continuing source of contamination for the water column and biota.

Leachate/contaminated groundwater from the Salina Landfill may also have contributed to contamination at the Site. However, the current remedy for the Salina Landfill includes a groundwater/leachate collection and pre-treatment system, which should eliminate the Salina Landfill as a source.

These sediments migrate downstream by both suspended load and bed-load transport. Bedload transport represents particles that roll or saltate along the river bottom without being brought into resuspension. Because these particles are not transported into the water column, they have no effect on the suspended sediment concentration. However, the effects of bed-load transport are significant because they change the thickness of the sediment bed and increase the rate of contaminant desorption from the transported sediments into the water column.

The processes that determine the fate of contaminants in Lower Ley Creek may be divided into two categories: 1) transport and 2) transfer and reaction. Transport is the physical movement of contaminants caused by the net advective movement of water, mixing, and resuspension/deposition of solids to which contaminants are adsorbed. It is dependent on the flow and dispersion characteristics in the water column and the settling velocity and resuspension rate of the solid particles. Transfer and reaction include movement of contaminants among air, water, and solid phases of the system, and biological (or biochemical) transformation or degradation of the contaminants. The processes involved in transfer and reaction include volatilization, adsorption, dechlorination, bioturbation, and biodegradation. Contaminants are present in Lower Ley Creek in three phases that interact with each other: freely dissolved; sorbed to particulate matter or solids; and complexed with dissolved (or colloidal) organic matter.

These complex sediment and water exchange processes govern the mechanisms that in turn contribute to bioaccumulation of contaminants in the fish via both benthic and pelagic food webs. These highly variable and complex processes include sediment resuspension and settling, biological mixing (bioturbation), sediment bedload transport, anthropogenic disturbances, flood events, ice-rafting, and other such related processes. The net result of these processes is that, in general, the distribution of contaminants in the sediments of Lower Ley Creek is fairly random. However, there does appear to be generally lower contaminant concentrations in sediments in the downstream section of Lower Ley Creek. Lower contaminant concentrations in the downstream section of Lower Ley Creek may be due its distance from the major initial source of contamination at the Site (i.e., the GM-IFG Facility).

Contaminant loss or gain from the sediment can take many forms. Scour, diffusion, groundwater advection, and biological activity can all potentially remove contaminants from a given location. Biological activity in the form of anaerobic microbial dechlorination can also serve to decrease contaminant concentrations in the sediments. Contaminant inventories can be increased chiefly by deposition, either with sediment contaminated by newly released chemicals or with redeposited sediments from other contaminated locations.

4.1.2 Soil Contamination

As previously discussed, dredging of Ley Creek was performed in the 1970s and early 1980s. Dredged material (i.e., spoils) generated during these dredging activities was placed along the banks of Ley Creek. This dredged material may continue to be a source of contamination to Lower Ley Creek as contaminants in the soil are leached to the creek. In addition, the soil is currently a significant source of contamination to the riparian corridor and associated upland ecological resources.

However, there is significant vegetation along Lower Ley Creek that may be minimizing any current erosion or transport of soil contaminants to Lower Ley Creek. Although the dredged material may have been a significant source of contamination to Lower Ley Creek initially, the revegetation of the banks after the dredging of the Creek has limited the mobility of the soil contaminants over time. Therefore, it appears that soil contamination along the shoreline of Lower Ley Creek may have at one time been a significant source of contamination for Lower Ley Creek, but currently may be a relatively minor source.

4.1.3 Contaminant Persistence

The continued high levels of sediment contamination in Lower Ley Creek indicate that most contaminants are persistent in the study area and are not being significantly degraded by natural processes. However, the random distribution of sediment contamination in Lower Ley Creek indicates that contaminants are being redistributed within the Site. This indicates that the stability of the sediment deposits cannot be assured. Burial of contaminated sediment by cleaner material is not occurring universally as high concentrations of contaminants were detected in samples collected on the top of the sediments (i.e., 0-1 ft bwsi). Although burial of more contaminated sediment by less contaminated sediment may be occurring at some locations, significant amounts of contamination may have been re-released to the environment. Therefore, it is likely that contaminants will continue to be released from Lower Ley Creek sediments.

4.2 HYDROLOGIC EVALUTION

The Lower Ley Creek watershed is very heavily developed and contains a mix of commercial and industrial uses. The gradient of Lower Ley Creek is minimal throughout the watershed, and elevation change as it approaches Onondaga Lake is minimal.

One U.S. Geological Survey (USGS) stream gauge (USGS 04240120) is operated in the Lower Ley Creek Subsite. This stream gauge is located near Onondaga Lake, where the Onondaga Lake Parkway (Park Street) crosses Lower Ley Creek (see Figure 2.2).

If a sediment remedial alternative other than "No Action" is selected, a detailed hydrologic analysis will be necessary in order to determine the effect of the chosen alternative on stream flow, flooding, and dynamics, appropriate materials and bathymetry for restoration, and long-term sustainability. This analysis will be performed as part of a remedial design prior to implementation of a remedial action.

4.2.1 Streamflow Characteristics

Runoff is typically low during the summer and early fall months, except during occasional frontal storms, and during midwinter when ice-cover forms or a snowpack is present in the watershed. Flood flows are most common during spring snowmelt, primarily early-March to mid-April. No temporal lag in flows is discernible using daily data, demonstrating the regional rather than local nature of flood events.

Streamflow characteristics for the Park Street stream gauge are summarized in Table 4.1. Monthly mean streamflows for Lower Ley Creek from 2000-2010 are exhibited in Figure 4.1 and peak flow events from 1974-2010 in Lower Ley Creek are shown in Figure 4.2.

4.2.2 Stream Channel Characteristics

To assist with the determination of remedial alternatives for sediment, the 2-mile stretch of the Lower Ley Creek Subsite has been separated into three sections (upstream, middle, and downstream). These sections are shown on Figure 2.5. This separation was made because the downstream section of the Site exhibits much less contamination than the upstream or middle sections of the Site. In addition, the upstream and middle sections of the Site exhibit distinctive stream characteristics. This separation forms a useful framework for describing channel characteristics of Lower Ley Creek. Each section is described qualitatively below:

- **Upstream:** Extends from just upstream of the Route 11 Bridge to the intersection with the 7th North Street Bridge. This section has been channelized at the upstream end such that most of the reach is an oversized, low gradient canal. Substrate in this section range from sand to clay with some small (1-4 centimeter) stones. Old Ley Creek enters Lower Ley Creek near the middle of the section and Beartrap Creek enters Lower Ley Creek at the downstream end of the section. Water depth is variable, but is typically between 2 to 4 ft deep. There are multiple bends and bridge crossings in this section of Lower Ley Creek.

- **Middle:** Extends from the intersection with 7th North Street Bridge to approximately 2,000 ft southwest of the intersection (near the Alliance Bank Stadium). This section consists of a generally straight, uniform, low gradient stream. Substrate in this section mostly consists of silt and clays. Water depth in this section is approximately 4 ft deep. There is only one bridge crossing in this section of Lower Creek.
- **Downstream:** Extends from approximately 2,000 ft southwest of the 7th North Street Bridge intersection to the intersection with Onondaga Lake. This section has a low gradient and substrate in this section mostly consists of silt and clay. Water depth is variable, but is typically between 8 to 12 ft deep. There are multiple bends and bridge crossings in this section of Lower Ley Creek.

Although, for the purposes of the FS, the upstream section of Lower Ley Creek includes the Old Ley Creek Channel, the Old Ley Creek Channel is quite different from Lower Ley Creek in hydrologic characteristics. While Lower Ley Creek is a functioning creek carrying regular and occasionally swift flows, Old Ley Creek has little to no flow and is currently functioning as more of a floodplain wetland.

4.2.3 Sediment Transport Characterization (Erosion and Depositional Environments)

This sediment transport evaluation considered field evidence of erosion (vertical, unvegetated banks; scour holes; coarse substrate) or deposition (mid-channel bars, multiple channels, fine-grained substrate, overbank deposition). In addition, observed depths of unconsolidated sediment were considered. This evaluation was performed comprehensively for the entire study area, and is presented in below. However, a more detailed and conservative evaluation of erosion potential is exhibited in Appendix E.

Most of the Lower Ley Creek channel is considered to be neither erosional nor depositional on the basis of field evidence (i.e., suspended sediment flux from the bed is likely to be balanced evenly between erosion and deposition, and material entering the section of the creek as suspended load can be transported through the section).

Lower Ley Creek is a simple hydrologic system exhibiting low hydraulic gradients, relatively weak erosional and depositional environments under typical stream flows, and small tributaries. In addition, Lower Ley Creek exhibits limited variations in the types of unconsolidated sediment (sand and silt), underlying material (silt and clay), and stream depth. The qualitative field observations from an experienced field team on the bathymetry and geomorphology of the stream, along with local knowledge of potential future disruptions to the stream environment (i.e., ice scouring, flooding, man-made disruptions) are sufficient to make an informed evaluation and final decision on sediment remedial alternatives.

For sediment cap design, a more conservative and detailed evaluation of erosion potential is required. This is due to the potential of extreme hydrodynamic conditions (i.e., floods, ice scouring) causing permanent damage to the sediment cap and creating contaminate releases. Appendix E details a more conservative evaluation of erosion potential necessary for sediment cap design.

5.0 GENERAL SCOPING OF THE FEASIBILITY STUDY

The framework for remedial alternative identification and screening is established under federal regulations at Title 40: Protection of the Environment, Part 300 – National Oil and Hazardous Substances Pollution Contingency Plan, Subpart E – Hazardous Substance Response (40 Code of Federal Regulations [CFR] Part § 300.430).

The primary objective of this FS is to ensure that appropriate remedial alternatives are developed and evaluated such that relevant information concerning the remedial action options can be presented to a decision maker and an appropriate remedy selected. Through the process, potentially suitable remedial technologies and process options, including innovative treatment technologies, are identified and evaluated. Suitable remedial technologies and process options are assembled into a range of remedial alternatives.

The range of remedial alternatives consists of treatment options that reduce the toxicity, mobility, or volume of the hazardous substances, pollutants, or contaminants. As appropriate, this range includes a remedial alternative that removes or destroys hazardous substances, pollutants, or contaminants to the maximum extent feasible, and eliminates or minimizes the need for long-term management. Other alternatives should be considered that, at a minimum, treat the principal threats posed by the site but vary in the degree of treatment employed and the quantities and characteristics of the treatment residuals and untreated waste that must be managed.

Consistent with state and federal guidance, this FS uses a multi-step evaluation process in identifying applicable remedial technologies for Lower Ley Creek (NYSDEC, 1990; EPA, 1988). The multi-step process helps to ensure that the full range of potentially applicable and/or available remedial technologies is evaluated and that an adequate range of technologies is included in developing a manageable set of remedial alternatives for detailed evaluation.

Before proceeding with a description of the evaluation process, it is worthwhile to consider some important definitions of terms that will be used throughout the remainder of this FS:

Remedial Technology – A discreet remedial technique, control method, tool, or process that may be useful for addressing some aspect of remediation at a site. A particular remedial technology may only address one type of contamination, situation, location, or contaminated matrix (e.g., soils, water, air), and therefore may only be useful in combination with other technologies or activities.

General Response Action (GRA) – This is a category or group of remedial technologies or overall processes that have some common element or approach. A GRA usually does not consider specific techniques or methods of application to a particular site.

Remedial Alternative – A comprehensive remediation scenario intended to provide overall remediation of a site. Remedial alternatives consist of combinations of remedial technologies that can be applied to various locations, situations, and/or matrices within the site to provide a comprehensive approach to remediation of the site. The term "alternative" is used because a number of different, alternative approaches to site-wide remediation are normally considered and compared to each other in the FS evaluation process. Applicable remedial alternatives include dredging, excavation, capping and monitored natural recovery (MNR).

The evaluation of remedial technologies and alternatives for this FS follow the *Technical and Administrative Guidance Memorandum #4030: Selection of Remedial Actions at Inactive Hazardous Waste Sites* (NYSDEC, 1990) and *Guidance for Conducting Remedial Investigations and Feasibility Studies Under Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA], Interim Final* (EPA, 1988). These two processes are very similar, and the NYSDEC guidance is consistent with much of the EPA CERCLA guidance.

The overall screening and evaluation process for this FS, which draws from these two documents, consists of the following steps:

1. Develop ARARs (Section 5.1), RAOs (Section 5.2) and PRGs (Section 5.3);
2. Identify areas and volumes of media that require remedial action (Section 5.4);
3. Develop GRAs and identify remedial technologies (Section 6.0);
4. Screen remedial technologies to eliminate those that cannot be implemented technically (Section 6.0);
5. Assemble the representative remedial technologies into appropriate remedial alternatives and conduct preliminary screening of the alternatives (Section 7.0);
6. Evaluate the remedial alternatives (Section 8.0); and
7. Perform a comparative analysis of all remedial alternatives against the evaluation criteria (Section 9.0).

5.1 INDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Section 121(d) of CERCLA, 42 U.S.C. § 9621(d), the NCP, 40 CFR Part 300, and guidance and policy issued by EPA require that remedies implemented under CERCLA comply with provisions of ARARs from federal and state environmental and facility siting laws during and at the completion of the remedial action (RA). ARARs are either “applicable” or “relevant and appropriate;” both types of requirements are mandatory under CERCLA and the NCP. Only those state standards that are identified by a state in a timely manner and those that are more stringent than federal requirements may be applicable or relevant and appropriate (40 CFR § 300.5). These requirements are threshold standards that any selected remedy must meet, unless an ARAR waiver is invoked.

The remedial alternatives developed and assessed in this FS use the preliminary determination of ARARs presented in Appendix A.

5.2 REMEDIAL ACTION OBJECTIVES

RAOs are developed to specify the requirements that the remedial action alternatives must fulfill to protect human health and the environment. The RAOs developed for the Site are:

Soil RAOs

- Reduce the cancer risks and non-cancer health hazards to human health from the incidental ingestion of and dermal contact with contaminated soil.
- Prevent migration of contaminants that would result in surface water contamination at levels that are associated with unacceptable ecological risk.
- Remediation of soil to levels that are of acceptable ecological risk.

Lower Ley Creek RAOs

- Prevent the direct contact with contaminated sediments.
- Reduce the cancer risks and non-cancer health hazards for people eating fish from Lower Ley Creek by reducing the concentration of contaminants in fish.
- Prevent releases of contaminant(s) from sediments that would result in surface water levels in excess of ambient water quality criteria.
- Prevent impacts to biota from ingestion/direct contact with sediments causing toxicity or impacts from bioaccumulation through the marine or aquatic food chain.
- Restore sediments to pre-release/background conditions to the extent feasible.
- Reduce the risks to ecological receptors by reducing the concentration of contaminants in fish.
- Minimize the current and potential future bioavailability of contaminants in sediments. Contaminants in sediments may become bioavailable by various mechanisms (e.g., pore water diffusion, bioturbation, biological activity, benthic food chains, ice jam scour, etc.).

5.3 PRELIMINARY REMEDIATION GOALS

The NCP requires the establishment of PRGs that can be used to select applicable remediation technologies and to develop remedial alternatives. The PRGs represent the primary goals of the remedial efforts, and can provide a range of quantitative values to be used during the evaluation of the various remedial alternatives. The ability of various remedial alternatives to actually achieve the PRGs was not a factor in their development.

PRGs are defined as the average concentration of a chemical in an exposure unit associated with a target risk level such that concentrations, at or below the remedial goal (RG), do not pose an unacceptable risk. PRGs are refined into RGs during the course of the RI/FS process based on cost, technical feasibility, community acceptance, uncertainty in the baseline risk assessment, schedule, and other risk management considerations. PRGs were developed based on the COPCs identified in the HHRA, COPCs identified in the BERA, and site-specific exposure pathways and receptors.

PRGs were also developed to address each of the RAOs through the application of a variety of quantitative measures. Lower Ley Creek has two primary media of concern, sediment and soils, and two secondary media of concern, surface water and fish tissue. Chemicals that are present in sediment are available for partitioning into fish tissue and the surface water. Consequently, actions that address chemicals in sediment will indirectly address chemicals in fish tissue and surface water. This applies to fish and other aquatic organisms with limited range. These organisms would be exposed to contaminated sediment for extended periods of time resulting in an increased probability of partitioning of chemicals in sediment to fish tissue.

COPCs were developed based on the COPCs identified in the HHRA, COPCs identified in the BERA, and site-specific exposure pathways and receptors. Table 5.1 presents the COPCs contributing to human health and ecological risks in Lower Ley Creek. Table 5.2 exhibits the chemical-specific PRGs for soil and Table 5.3 exhibits the chemical-specific PRGs for sediment. Details on the determination of the PRGs are presented in Appendix B.

5.4 CLEANUP GOALS

As previously discussed in Section 2, the Site is located within a highly urbanized area of Eastern Syracuse, New York. Lower Ley Creek is surrounded by manufacturing operations, parking lots, a landfill, railroad tracks, and commercial operations. This has been a commercial/industrial area for at least 50 years and will continue to be a commercial/industrial area for the foreseeable future. However, the Site also contains an undeveloped riparian corridor that includes Old Ley Creek, Lower Ley Creek, and the adjacent wetlands and floodplains associated with these surface water bodies. Therefore, cleanup goals are based both on commercial use and the protection of ecological resources.

5.4.1 Sediment Cleanup Goals

As documented in the ROD for the Crouse-Hinds Landfills State Superfund Project (Site No. 734004), located along the southern shore of Lower Ley Creek, the cleanup goal of 1 mg/kg PCBs in creek sediment is recognized as a previously selected sediment cleanup goal at NYS Hazardous Waste Sites (NYSDEC, 2011). Therefore, 1 mg/kg PCBs was used as a cleanup goal for sediments at Lower Ley Creek. Additional areas exhibiting sediments below 1 mg/kg PCBs were added to the sediment remedial alternatives based on elevated concentrations of other risk drivers (i.e., chromium and PAHs).

5.4.2 Soil Cleanup Goals

Cleanup goals for soil were based on 6 NYCRR Part 375 Soil Cleanup Objectives (SCO) for Commercial Use and the Protection of Ecological Resources. Although the area is a riparian corridor, widespread landfilling exists beneath much of the soil areas and the surrounding land use is industrial and commercial. For soils shallower than 2 ft bgs, the lower value between Commercial Use SCOs and Ecological SCOs was used as a cleanup goal. For soils deeper than 2 ft bgs, Commercial Use SCOs were used as cleanup goals as there are very limited ecological pathways and exposures deeper than 2 ft bgs. Cleanup Goals for soil are exhibited in Table 5.4.

5.5 IDENTIFY AREA AND VOLUMES OF MEDIA THAT REQUIRE REMEDIAL ACTION

Consistent with CERCLA guidance, this subsection develops the areas and volumes that may require remediation based on the cleanup goals. Areas and volumes are developed for each media (soil and sediment). These areas and volumes will be used to guide the development and screening of remedial technologies. Please note that these estimated areas and volumes are preliminary estimates used for cost comparison purposes.

5.5.1 Extent of Contamination in Soil

Table 5.5 presents the volume of soil to be considered for remediation based on exceedances of the cleanup goals listed in Table 5.4. Soils along the 2-mile stretch of Lower Ley Creek have been separated into two areas (Southern Swale Soil Area and Northwest Soil Area) to assist with determining remedial alternatives for the Site.

The existing data set from the *Old Ley Creek Channel Final RI Report* (EA, 2010) and the *SERAS Field Activity Summary Report* (SERAS, 2012) were used to calculate the areal extent of soils exceeding the relevant cleanup goals. In some cases, the cleanup goals were exceeded at the deepest extent of the data. Therefore, Table 5.5 provides volumes based on the data available, lithology, and field observations.

5.5.2 Extent of Contamination in Sediments

Table 5.6 presents the volume of sediment to be considered for remediation based on the exceedance of 1 mg/kg PCB and other risk drivers at the site. Sediments along the 2-mile stretch of Lower Ley Creek have been separated into three sections (upstream, middle, and downstream) to assist with determining remedial alternatives for the Site.

The existing data set from the *Old Ley Creek Channel Final RI Report* (EA, 2010) and the *SERAS Field Activity Summary Report* (SERAS, 2012) were used to calculate the areal extent of sediments exceeding the relevant cleanup goals. In some cases, the cleanup goals were exceeded at the deepest extent of the data. Therefore, Table 5.6 provides volumes based on the data available, sediment lithology, and field observations.

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6.0 GENERAL RESPONSE ACTIONS AND APPLICABLE SCREENING TECHNOLOGIES

This section includes identification and review of GRAs and potentially applicable remedial technologies and process options for the contaminated media of concern (sediment and soil). GRAs are initial broad response actions considered to address the preliminary RAOs for the contaminated media identified as a concern at the site. GRAs include several remedial categories, such as containment, removal, disposal, and treatment of contamination for each medium of concern. Site-specific GRAs are first developed to satisfy the preliminary RAOs for the contaminated media and then are evaluated as part of the identification and screening of remedial technologies and process options for the contaminated media.

6.1 GENERAL RESPONSE ACTIONS

The GRAs considered for remediation of the media of concern (sediment and soil) are listed below:

- No Action;
- Institutional Controls;
- Monitored Natural Restoration;
- Containment and Engineering Controls;
- Removal (dredging/excavating) and Disposal;
- In Situ Treatment; and
- Ex Situ Treatment.

These GRAs and their associated remedial technologies are presented in Table 6.1 and discussed below from the generally least active (e.g., no action) to the most active.

6.1.1 No Action

Under the no action alternative, no remedial action would be implemented. The no action alternative reflects Site conditions as described in the baseline risk assessments (SERAS, 2012). No action was retained as a GRA to serve as a baseline for comparison with other methods, technologies, and process options.

6.1.2 Institutional Controls

Institutional controls are activities that do not involve active remediation. In most cases, these are activities, documents, informational devices, or legal restrictions that minimize, limit, or prevent human exposures to COPCs. This GRA can include physical site activities such as installation of warning signs, fencing, and surveillance. It can also include purely legal documents and methods of public communication such as deed restrictions, new regulations, and fishing advisories.

Institutional controls are widely recognized as a potential remedial technology for sediment sites (EPA, 2002). However, these controls are often only suitable when used in combination with other, more active remedial technologies. Further, the NCP preamble states that institutional controls are not intended to be a substitute for active response measures unless such measures are not practicable. Thus, institutional controls should be viewed as a means to further reduce risks where other technologies are infeasible, partially effective, or require some period of time before they become effective.

EPA has placed institutional controls into four broad categories:

- Governmental Controls;
- Property Controls;
- Enforcement Tools; and
- Informational Devices.

The specific technologies or activities recognized by EPA as most applicable to sediment sites (EPA, 2002) are:

- Fish consumption advisories and commercial fishing bans;
- Waterway use restrictions; and
- Land use restriction/structure maintenance.

Based on these categories and general information on the creek, institutional controls that may be applicable to Lower Ley Creek include use restrictions preventing exposure to or disturbance of sediments or other impacted media, such as:

- Health advisories regarding specific activities; and
- Bans on, or permit requirements for, dredging and/or certain waterfront improvements or alterations.

As a tributary of Onondaga Lake, Lower Ley Creek is currently under a New York State Department of Health (NYSDOH) fish advisory. This advisory recommends that women under age 50 and children under the age of 15 eat no fish of any species. For older women and adult males, the advisory recommends the following:

- Eat no largemouth and smallmouth bass over 15 inches, carp, channel catfish, white perch, and walleye;
- Eat up to four meals per month of brown bullhead and pumpkinseed; and
- Eat up to one meal per month of all other fish.

6.1.3 Monitored Natural Recovery

Natural restoration involves allowing natural processes to decrease the concentration, mobility, bioavailability, toxicity, and/or exposure of chemicals. Generally, it is allowed to occur over a given time frame and is expected to achieve specified goals within that time frame. Natural restoration always includes a monitoring component to confirm that decreases in chemical concentrations or exposures are actually taking place as expected. It also includes contingency planning procedures if sufficient natural recovery is not observed. Such contingency planning might involve a range of activities from additional monitoring to implementing more active remedial technologies.

MNR can occur through a variety of physical, chemical, and biological processes that act alone or in combination to reduce chemical concentrations, exposure, and/or mobility in sediments. MNR usually includes the following primary mechanisms that affect the surface of the sediment bed:

- Mixing of incoming clean sediments from the water column with creek sediment chemicals, causing dilution of the chemical concentrations (often the first step before burial);
- Burial of creek sediments containing chemicals by incoming clean sediments from the water column;
- Degradation of organic compounds within sediments;
- Reduction of chemical mobility and/or toxicity by conversion to less toxic forms and/or forms that are more highly adsorbed to creek sediments;
- Diffusion/advection of chemicals to the water column (i.e., loss to the water column); and
- Transport of sediments containing chemicals and dispersion over wider areas at lower concentrations.

It is important to note that these processes are interrelated and do not always work synergistically. For example, if sediments from the water column containing high chemical concentrations are settling onto creek sediments, these chemical inputs may offset any decreases in sediment chemical concentrations caused by burial, diffusion/advection, and/or degradation. This is why source control is a necessary first step in any MNR scenario. The last two of these MNR mechanisms may not always be desirable. Clearly, dispersion of chemicals over wider adjacent areas or to other media that increases toxicity in those areas and media cannot be considered natural recovery. Thus, it is important that natural recovery evaluations considering these processes evaluate the potential impact of substantial reduction in one area or medium to toxicity and risks elsewhere in the system.

Reduction of chemical mobility and/or toxicity by conversion as well as degradation is highly dependent on a number of factors, including the type of chemicals present, concentrations of those chemicals, and the rates of any conversion or degradation processes. Consequently, MNR may not degrade or reduce the toxicity of contaminated sediments in many circumstances. In some cases (such as heavy metals), the primary mechanism of MNR is isolation by burial over time.

6.1.4 Containment and Engineering Controls

Sediment containment technologies can reduce potential exposure to human and ecological receptors by preventing direct contact with contaminated sediments/soils and reducing the flux of chemicals into the water column. The most common containment technology is capping. Variations of capping technology can include:

- Engineered sediment cap with erosion controls;
- Engineered capping with reactive materials; and
- Thin-layer capping (for sediments and soils).

6.1.4.1 Granular Material Sediment Cap

A granular material sediment cap includes the installation of a granular material (sand) sediment cap over contaminated sediments. In areas of high erosion potential, granular material sediment caps consist of an armor stone layer overlying a sand isolation layer. Finally, a 2 ft habitat layer is placed on top of the cap to facilitate the re-colonization of the stream bottom by native species. Before the placement of any capping material, excavation of sediment is usually conducted to maintain the current bathymetry of the water body.

6.1.4.2 Engineered Bentonite Cap

An engineered bentonite cap is designed to hydrate and form a continuous and highly impermeable isolation layer over contaminated sediments. Engineered bentonite caps are typically produced for application in relatively shallow, freshwater to brackish, generally nearshore environments and is comprised of bentonite clay with polymer additives covering a small aggregate core. The bentonite clay is comprised principally of montmorillonite, and the proprietary polymer is added to further promote the adhesion and coalescing of clay particles to the aggregate core. The aggregate core is used essentially for weighting to promote the sinking of the material to the sediment surface. An engineered bentonite cap functions by hydrating, swelling, and forming a continuous and highly impermeable isolation layer above contaminated sediments. After the placement of the bentonite, a 2 ft habitat layer is placed on top of the cap to facilitate the re-colonization of the stream bottom by native species. Before the placement of any capping material, excavation of sediment is usually conducted to maintain the current bathymetry of the water body.

6.1.5 Removal and Disposal

Removal includes dredging/excavating contaminated sediments/soils from their existing location and consolidating/disposing the sediments/soils in a new location that minimizes the mobility, exposure, or impacts to human health and the environment. It is one of the most commonly evaluated and implemented contaminated sediment remediation technologies (EPA, 2002). Removal and on-site consolidation or off-site disposal are presented in Table 6.1 as separate GRAs, but in reality, they can only occur in combination.

6.1.5.1 Dredging (Sediments)

Sediment may be removed from a water body using various dredging techniques (Herbich, 2000). Dredging involves mechanically penetrating, grabbing, raking, cutting, and/or hydraulically scouring the bottom of a water body to dislodge and remove sediment. After the sediment has been dislodged, it is lifted out of the water body either mechanically, as with a clamshell bucket, or hydraulically through a pipeline. Dredging at a site can also be based on a combination of mechanical and hydraulic methods. Hybrid dredges can remove sediments by either mechanical or hydraulic means, depending on site conditions. Pneumatic dredges, a subset of hydraulic dredges, use compressed air systems to remove sediments. Hybrid and pneumatic dredges are generally less available than purely mechanical or hydraulic systems. In addition, their historical use at contaminated sediment projects is relatively limited.

6.1.5.2 Excavation (Sediments and Soils)

Dry excavation of sediments involves isolating an area using a temporary dam, removing the enclosed surface water, and excavating the contaminated sediment with conventional earthwork equipment. Wet excavation of sediments can also be conducted by excavating the contaminated sediment while it is submerged in the water using conventional earthwork equipment. The equipment may need to be placed on support mats to avoid sinking in the soft sediments during construction. This technique allows a visual verification that the appropriate sediment is being removed. It also significantly reduces the amount of sediment dewatering required and eliminates the short-term problem of sediment resuspension in the water column during removal.

Impacted soil along the shores of Lower Ley Creek can also be removed by excavating soil with conventional earthwork equipment.

6.1.6 In Situ Treatment

In situ treatment can include a number of methods that alter sediments and soils in their existing environment to reduce chemical concentration, mobility, bioavailability, and/or toxicity. Table 6.1 lists the primary treatment categories. Agents added to the sediment can include energy, chemicals, microorganisms, or plants. In some cases, the treatment may involve physical mixing or other manipulation of the media. Some forms of in situ treatment require isolation (via berms or dams) of the area to be treated to prevent loss of chemicals or other agents to surrounding areas. In addition, as with any invasive remediation technology, any existing habitats or biological communities would be impacted in the short-term during in situ treatment implementation.

6.1.7 Ex Situ Treatment

Table 6.1 reviews the various ex situ treatment technologies in detail; this detailed review is only summarized in the following text. This technology is often considered separately from removal, but in reality, ex situ treatment and removal must occur in combination. Once removed and treated, the sediments/soils must be managed by placement in a suitable location. If the media have been rendered non-toxic, some form of beneficial reuse can also be considered. Because removal and placement technologies have been previously described, this subsection focuses on the treatment phase of such an application.

There is a vast array of different treatment types, and as with in situ treatment, they reduce the concentration, mobility, bioavailability, and/or toxicity of the chemicals present in the media of concern. Depending on the physical and chemical characteristics of the media after the treatment process, sediments and soils might have a variety of end uses or placement options.

6.2 INFORMATION SOURCES USED TO IDENTIFY REMEDIAL TECHNOLOGIES

Various databases, technical reports, and publications, were used to identify and evaluate remedial technologies for use at the Lower Ley Creek site including:

- Superfund Innovative Technology Evaluation (SITE) Program (EPA, 1999);
- Selecting Remediation Techniques for Contaminated Sediment (EPA, 1993);
- Assessment and Remediation of Contaminated Sediments (ARCS) Program Remediation Guidance Document (EPA, 1994);
- EPA Hazardous Waste Clean-up Information (CLU-IN) web site (EPA, 2000a);
- EPA Remediation and Characterization Innovative Technologies (EPA REACH IT) database (EPA, 2000b);
- Federal Remediation Technologies Roundtable (FRTR, 1999) web site; and
- Remediation Technologies Network (RTN) Remediation Information Management System (RIMS) (RIMS, 2000) Database.

The SITE Program was created by EPA to encourage the development and use of innovative treatment and monitoring technologies. Under the program, EPA works with and supports technology developers who research, refine, and demonstrate innovative technologies at hazardous waste sites. SITE demonstration project information is compiled and can be used as a reference guide on innovative treatment technologies.

The ARCS Program was initiated in 1987 by EPA's Great Lakes National Program Office (GLNPO) to address sediment contamination in the Great Lakes. The ARCS program consisted of a 5-year study and demonstration projects relating to the treatment of contaminated sediments. The ARCS remediation guidance document is a product of the ARCS Program, and was prepared by the Engineering/Technology Work Group (ETWG), a working committee under the ARCS Program. The guidance document provides information on the selection, design, and implementation of sediment remediation technologies, including feasibility evaluation, testing technologies, and effectiveness at past site projects.

The EPA CLU-IN web site provides information about innovative treatment technologies and includes descriptions of and contact information for relevant programs and organizations. It also provides access to publications (e.g., Tech Trends) and other tools useful in technology review and evaluation.

The EPA REACH IT database combines information from three established EPA databases, the Vendor Information System for Innovative Treatment Technologies (VISITT) database, the Vendor Field Analytical and Characterization Technologies System (Vendor FACTS) database, and the Innovative Treatment Technologies (ITT) database. This database combines vendor-supplied information with information from the EPA, the U.S. Department of Defense (DOD), the U.S. Department of Energy (DOE), and state project managers regarding sites at which innovative technologies have been implemented, and provides information on over 1,400 remediation technologies and 750 vendors.

The FRTR describes itself as an interagency group seeking to improve the collaborative atmosphere among federal agencies involved in hazardous waste site remediation. Member agencies include the DOD, DOE, U.S. Department of the Interior (DOI), U.S. Department of Commerce (DOC), U.S. Department of Agriculture (DOA), and the EPA. Its web site contains such information as cost and performance of remedial technologies, results of technology development and demonstration, and technology optimization and evaluation.

The RIMS 2000 database, owned and operated by the Research Technologies Network, L.L.C., contains remedial technology information on nearly 900 technologies. It includes technical paper abstracts, summaries, and components of remediation efforts undertaken since the inception of CERCLA in 1980. This information is verified and updated by RTN on a monthly basis to provide current and objective information on the status of innovative technologies.

These and other resources were used to identify a number of potentially applicable remedial technologies or process options for dealing with contaminated soils and sediments.

6.3 IDENTIFATION AND SCREENING OF APPLICABLE REMEDIAL TECHNOLOGIES

During this identification of remedial technologies, a wide range of potential remedial technologies and process options were reviewed. Based on this review, potential remedies unable to remediate the contaminated media due to site conditions or the lack of compatibility with the contaminated media were eliminated from further consideration. The initial identification and screening of remedial technologies for Lower Ley Creek is presented in Table 6.1. These technologies were developed based on the GRAs discussed above. These technologies were screened to ensure that only those technologies applicable to the contaminants present, the physical matrix, and other site characteristics were considered.

As an initial screening, each of the potentially applicable remedial technologies was evaluated in terms of effectiveness, implementability, and cost.

6.3.1 Effectiveness

Effectiveness focuses on the degree to which a remediation technology or alternative reduces the toxicity, mobility, or volume of hazardous substances through treatment and achieves long-term protection. The effectiveness criterion also considers the degree to which the option complies with the ARARs, minimizes short-term impacts, and also how quickly it achieves protection.

6.3.2 Implementability

Implementability includes both the technical and administrative feasibility of implementing a technology process or a remedial alternative. Consideration of implementability with respect to a remedial technology or a remedial alternative focuses on the administrative implementability of an option, including necessary permits for off-site actions; the availability of treatment, storage, and disposal facilities; and the availability of necessary equipment and skilled workers to implement a remedial technology or a remedial alternative.

6.3.3 Cost

Cost plays a limited role in the screening stage; only order-of-magnitude costs are developed. For remediation technologies, processing costs were assumed to include all the costs associated with the treatment other than capital and mobilization costs. Technologies or remediation alternatives that may be significantly more costly without any offsetting benefit over comparable options may be screened out.

7.0 IDENTIFICATION AND SCREENING OF REMEDIAL ALTERNATIVES

This section presents the remedial alternatives developed for the Lower Ley Creek Site and an initial evaluation of these alternatives based on effectiveness, implementability, and cost. In general, the remedial alternatives were developed to meet Site RAOs for each medium of concern. These remedial alternatives were developed to:

- Be protective of human health and the environment;
- Attain chemical-specific ARARs (unless a waiver is justified) and can be implemented in a manner consistent with location-specific and action-specific ARARs;
- Use permanent solutions and alternative treatment technologies to the maximum extent practicable; and
- Be capable of achieving the RAOs in a cost-effective manner.

Soil and sediment remedial alternatives were developed and screened separately. The proposed plan will recommend one soil remedial alternative and one sediment alternative.

7.1 SOIL REMEDIAL ALTERNATIVES

Four soil remedial alternatives (including the No Action alternative) were developed for the Site. These alternatives are presented in Table 7.1.

To assist with the determination of remedial alternatives for soil, site soils have been separated into two areas (Southern Swale Soils and Northwest Soils) (Figure 2.4). This separation was made because there are specific remedial challenges associated with each area. While the Northwest Soil area has two large buried pipelines to consider, remediation of the Southern Swale Soil area may require limited wetland restoration.

In addition, the alternatives were screened based on the criteria of effectiveness, implementability, and cost. This initial screening step was performed as required by CERCLA and the NCP to narrow the field of remedial alternatives that are subject to the detailed analysis presented in Section 8. The initial screening of all four soil remedial alternatives is presented in Table 7.2. All soil remedial alternatives passed the screening and were retained for additional evaluation.

7.1.1 Soil-1: No Action

Soil Alternative 1 is the No Action alternative and is presented for comparison only. The No Action Alternative consists of refraining from the active application of any remediation technology to soils of Lower Ley Creek. The No Action alternative also excludes source control removal action, administrative actions, and monitoring. As required by CERCLA, periodic reviews will be conducted at 5-year intervals to reassess the long-term appropriateness of continued No Action.

The RAOs for soil will never be achieved using under this remedial alternative.

7.1.2 Soil-2: Excavation of Soil to Meet Cleanup Goals

Soil Alternative 2 includes both excavation and installation of a soil cap in select locations. In the Southern Swale Soil Area, all soil with COPCs above SCOs will be excavated to meet the cleanup goal. Excavated soils would be disposed of in an off-site RCRA-compliant and, if appropriate, a TSCA-compliant disposal facility. The extent of the Southern Swale Soil excavation under Soil Alternative 2 is shown in Figure 7.1. In the Northwest Soil Area, all soils with COPCs above SCOs will be excavated to meet cleanup goals, except in areas near the two pipelines are located in the Northwest Soil Area. The extent of the Northwest Soil excavation and soil cap is shown in Figure 7.2. Based on restrictions imposed on the field sampling team during the site investigation, it is likely that there will be a 20-ft wide “safety zone” digging restriction near the pipelines. Therefore, in areas adjacent to and above the pipelines, a soil cap will be installed above contaminated soil that cannot be excavated. Details on the total volume of soil to be excavated and the total volume of soil to be capped under this alternative are presented in Table 7.3.

This alternative includes excavation and off-site disposal of soils with COPCs exceeding cleanup goals. However, on-site disposal may potentially be possible at the Cooper Crouse-Hinds North Landfill or additional landfills located adjacent to Lower Ley Creek. Therefore, cost estimates for this alternative have been estimated for on-site disposal (Appendix C, Table C-1) and off-site disposal (Appendix C, Table C-3).

Clean backfill will then be placed to bring the excavation back to the original grade. Topsoil will be placed over disturbed areas and seeded to grow vegetation to reduce or eliminate erosion from the disturbed areas.

This alternative also includes a soil cap for soils located adjacent to and above the pipelines. The soil cap will be a 1-ft thick layer of clean soil to isolate the contaminated soils. The soil cap will be a vegetated habitat layer. A demarcation layer (e.g., non-woven geotextile) will be installed between the contaminated soil and the soil cap. The soil cap will be seeded to grow vegetation that will reduce or eliminate erosion from the areas. Vegetation in the soil cap areas will be restored, including trees and shrubs, to create a riparian buffer. In all areas, an excavation will be completed before the soil cap is installed so there is no loss of floodplain capacity.

This soil cap serves three functions:

1. It isolates and covers the remaining contaminated soil to prevent movement.
2. It creates a clean soil surface.
3. It reduces the human health and ecological pathways for contact with contaminated soil.

It is estimated that soil RAOs will be achieved in approximately 6 months after initiation of remedial activities under Soil Alternative 2. This is based on the period of active construction required to implement this alternative.

7.1.2.1 Restoration

7.1.2.1.1 Baseline Sampling

Prior to remedial and restoration activities, a baseline survey will be conducted at the site. The survey will be conducted in the fall, if feasible, and will be used for comparative purposes during the monitoring phase of restoration activities. The baseline survey will include vegetation identification and data collection using the line interception method (discussed further below). In addition, permanent photo locations will be established throughout the restoration area. Photos will be taken at these locations during the baseline survey and during each of the annual monitoring events.

7.1.2.1.2 Site Restoration

Restoration activities will be initiated following the completion of remedial activities and will consist of the re-establishment of native vegetation within the disturbed area. Restoration of the riparian zone will provide erosion protection for Ley Creek associated with surface water runoff from the surrounding industrial areas. In addition, utilizing native species within the restoration activities will create native habitat within the riparian zone. Restoration activities and post-restoration monitoring activities are described below. Further details and specifications relative to site restoration will be presented in the remedial design component.

According to the Ecoregions of the United States, the historical regional vegetation for the project area consisted of native plant species typical of transitional deciduous forests between the boreal forests and broadleaf deciduous forests. The most abundant trees within this Ecoregion include oaks, maples, and beech (EPA, 2013). The site currently consists primarily of forbs and grasses near the bank of Ley Creek and a combination of forbs, grasses, woody shrubs, and deciduous forest within the riparian area.

Seeding and planting will begin as soon as possible and practicable after the completion of remedial activities. If feasible, the remedial action will be scheduled so that seeding and planting will be conducted in the spring or fall in order to maximize planting success. Species composition will be designed to reflect the existing communities of native species as well as native communities of the region, and will include a combination of trees, shrubs, forbs, and grasses. Information relative to the existing species composition will be gathered during the baseline survey. Accordingly, the desired species composition for the selection of terrestrial community composition will be finalized during the remedial design and/or after the completion of the baseline survey. Examples of likely species to be selected are listed below. The tree, shrub, and grass species are native to either the Eastern Great Lakes ecoregion and/or the state of New York (NYSDEC, 2005).

Trees: red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), red oak (*Quercus rubra*), and American beech (*Fagus grandifolia*)

Shrubs: redosier dogwood (*Cornus stolonifera*), silky dogwood (*Cornus amomum*), and highbush cranberry (*Viburnum opulus)*

Grasses: big bluestem (*Andropogon gerardii*), little bluestem (*Andropogon scoparium*), and switchgrass (*Panicum virgatum)*

The selected tree and shrub species will be planted as seedlings, likely using bare root seedlings. Trees and shrubs will be planted within the disturbed area at distances greater than an established distance (e.g., 50 ft) from the bank of Ley Creek. The seedling spacing and the type of nursery stock to be planted (e.g., bare root, ball and burlap, cuttings, etc.) will be identified within the restoration plan to be completed within the remedial design.

Grasses will be planted from seed and will be planted throughout the entire disturbed area, regardless of distance from the bank of Ley Creek. The specific mix, application rate, and type of seed application (i.e., dry seeding, hydroseeding, etc.) will be identified within the restoration plan to be completed within the remedial design.

7.1.2.1.3 Success Criteria

To evaluate the effectiveness of restoration efforts, success criteria will be established. These will likely include a goal of percent survivorship (e.g., 70%), a goal of total percent cover (e.g., 90%) beginning with the first annual monitoring event, and a minimum number of seeded species present. Success criteria will be identified within the restoration plan as part of the remedial design.

Vegetation planted on the cover layer will help stabilize the cover material to prevent movement into Lower Ley Creek. The final depth of soil removal and thickness of the soil cap will be refined during the pre-design phase. In addition, this alternative would require a site management plan to manage the soil cap and the remaining contamination at the site.

7.1.2.2 Monitoring and Controls

Monitoring will be conducted to evaluate the effectiveness of the restoration efforts. The monitoring program will direct maintenance as needed and document recovery of resources. Monitoring will likely occur on an annual basis for a 5-year period following the completion of restoration activities. Annual monitoring events will consist of a vegetation survey conducted using the line interception method. Annual monitoring events will be conducted in the fall. Visual meander surveys also will be conducted in the late spring/early summer to document species composition.

7.1.2.2.1 Sampling Methodology

The baseline and monitoring surveys will consist of collecting vegetative data using the line interception method (Canfield, 1941). The line interception method is a method of sampling vegetation based on the measurement of all plants intercepted by the vertical plane of a given transect. Linear measurements are then made of the intercepts of vegetation along the transect.

Because the monitoring will occur for 5 years, permanent transects will be established within the restoration area and surveyed each year. A minimum of 12 transects will be established within the riparian area, each of which will be approximately 150 ft long. Approximately six transects will be oriented parallel to Ley Creek, with three transects within the forested area and three transects within the non-forested area. The remaining six transects will be oriented perpendicular to Ley Creek.

Vegetative data collected within the survey will be used to determine percent plant cover at which plant species occur, as well as species composition. This information will be compared to success criteria, established above, to evaluate the restoration's success and, if necessary, adjust management practices. The following metrics will be calculated using the vegetative data.

Absolute % Cover (Species-Specific) = Intercept Length (ft)/Transect Length (ft)*100

Total Cover = Sum of Species Specific Absolute Cover Measurements

Relative % Cover (Species-Specific) = Absolute Cover/Total Cover*100

Species Composition = Total List of Observed Species

7.1.2.2.2 Percent Survivorship

Percent survivorship is a measure of how many planted seedlings survive after planting. Because the measure is relative to individual plants, this metric is only applicable to shrubs and trees. To determine percent survivorship, the number of planted seedlings will be counted during planting and during each monitoring event. Given the size of the restoration area, counting individual trees or shrubs across the entire site will not be feasible. Accordingly, percent survivorship will be calculated from established sample plots within the restoration area. This data will be used to determine the percentage of planted seedlings that has survived. The size, location, and frequency of sample plots will be determined within the restoration plan as part of the remedial design.

7.1.2.2.3 Controls

As part of this alternative, controls will be implemented as part of a site management plan to restrict excavation and construction activities in the soil cap areas. Institutional controls could include, but would not be limited to, potential land-use controls (LUC), environmental easements, deed notices, and public health advisories.

Additional controls will likely include fencing and signage. Fencing will be installed next to potential public access locations (i.e., roads) and should not significantly affect the movement of wildlife.

7.1.3 Soil-3: Excavation of Southern Swale Soils to Meet Cleanup Goals and Soil Capping of Northwest Soils

Soil Alternative 3 includes both excavation and installation of a soil cap in select locations. In the Southern Swale Soil Area, all soil with COPCs above cleanup goals will be excavated to meet the cleanup goal. Excavated soils will be disposed of in an off-site RCRA-compliant and, if appropriate, a TSCA-compliant disposal facility. The extent of the Southern Swale Soil excavation under Soil Alternative 3 is shown in Figure 7.1. In the Northwest Soil Area, all soils with COPCs above cleanup goals would either be excavated or covered with a soil cap. The extent of the Northwest Soil excavation and capping is shown in Figure 7.3. Details on the total volume of soil to be excavated and the total volume of soil to be capped under this alternative are presented in Table 7.4.

This alternative includes excavation and off-site disposal of soils with COPCs exceeding cleanup goals. However, on-site disposal may be possible at the Cooper Crouse-Hinds North Landfill or additional landfills located adjacent to Lower Ley Creek. Therefore, cost estimates for this alternative have been estimated for on-site disposal (Appendix C, Table C-1) and off-site disposal (Appendix C, Table C-3).

Clean backfill will then be placed to bring the excavation back to the original grade. Topsoil will be placed over disturbed areas and seeded to grow vegetation to reduce or eliminate erosion from the disturbed areas.

This alternative also includes a soil cap for some soils located in the Northwest Soil Area. The soil cap will be a 1-ft thick layer of clean soil to isolate the contaminated soils. The soil cap will be a vegetated habitat layer. A demarcation layer (e.g., non-woven geotextile) will be installed between the contaminated soil and the soil cap. A 2-ft thick habitat layer will be placed above the soil cap and will be seeded to grow vegetation that would reduce or eliminate erosion from the areas. Vegetation in the soil cap areas would be restored, including trees and shrubs, to create a riparian buffer. Periodic reviews will be conducted at 5-year intervals to reassess the long-term appropriateness of this alternative.

In all areas, an excavation of 3 ft of soil would be completed before the soil cap is installed so there is no loss of floodplain capacity. Due to this requirement, soil caps will only be placed in areas exhibiting contamination deeper than 3 ft bgs. Any areas with contamination less than 3 ft deep will be excavated and replaced with backfill.

This soil cap serves three functions:

1. It isolates and covers the remaining contaminated soil to prevent movement.
2. It creates a clean soil surface.
3. It reduces the human health and ecological pathways for contact with contaminated soil.

It is estimated that soil RAOs will be achieved in approximately 6 months after initiation of remedial activities under Soil Alternative 3. This is based on the period of active construction required to implement this alternative.

7.1.3.1 <u>Restoration</u>

7.1.3.1.1 Baseline Sampling

Prior to remedial and restoration activities, a baseline survey will be conducted at the site. The survey will be conducted in the fall, if feasible, and will be used for comparative purposes during the monitoring phase of restoration activities. The baseline survey will include vegetation identification and data collection using the line interception method (discussed further below). In addition, permanent photo locations will be established throughout the restoration area.

Photos will be taken at these locations during the baseline survey and during each of the annual monitoring events.

7.1.3.1.2 Site Restoration

Restoration activities will be initiated following the completion of remedial activities and will consist of the re-establishment of native vegetation within the disturbed area. Restoration of the riparian zone will provide erosion protection for Ley Creek associated with surface water runoff from the surrounding industrial areas. In addition, utilizing native species within the restoration activities will create native habitat within the riparian zone. Restoration activities and post-restoration monitoring activities are described below. Further details and specifications relative to site restoration will be presented in the remedial design component.

According to the Ecoregions of the United States, the historical regional vegetation for the project area consisted of native plant species typical of transitional deciduous forests between the boreal forests and broadleaf deciduous forests. The most abundant trees within this Ecoregion include oaks, maples, and beech (EPA, 2013). The site currently consists primarily of forbs and grasses near the bank of Ley Creek and a combination of forbs, grasses, woody shrubs, and deciduous forest within the riparian area.

Seeding and planting will begin as soon as possible and practicable after the completion of remedial activities. If feasible, the remedial action will be scheduled so that seeding and planting will be conducted in the spring or fall in order to maximize planting success. Species composition will be designed to reflect the existing communities of native species as well as native communities of the region, and will include a combination of trees, shrubs, forbs, and grasses. Information relative to the existing species composition will be gathered during the baseline survey. Accordingly, the desired species composition for the selection of terrestrial community composition will be finalized during the remedial design and/or after the completion of the baseline survey. Examples of likely species to be selected are listed below. The tree, shrub, and grass species are native to either the Eastern Great Lakes ecoregion and/or the state of New York (NYSDEC, 2005).

Trees: red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), red oak (*Quercus rubra*), and American beech (*Fagus grandifolia*)

Shrubs: redosier dogwood (*Cornus stolonifera*), silky dogwood (*Cornus amomum*), and highbush cranberry (*Viburnum opulus)*

Grasses: big bluestem (*Andropogon gerardii*), little bluestem (*Andropogon scoparium*), and switchgrass (*Panicum virgatum)*

The selected tree and shrub species will be planted as seedlings, likely using bare root seedlings. Trees and shrubs will be planted within the disturbed area at distances greater than an established distance (e.g., 50 ft) from the bank of Ley Creek. The seedling spacing and the type of nursery stock to be planted (e.g., bare root, ball and burlap, cuttings, etc.) will be identified within the restoration plan to be completed within the remedial design.

Grasses will be planted from seed and will be planted throughout the entire disturbed area, regardless of distance from the bank of Ley Creek. The specific mix, application rate, and type of seed application (e.g., dry seeding, hydroseeding, etc.) will be identified within the restoration plan to be completed within the remedial design.

7.1.3.1.3 Success Criteria

To evaluate the effectiveness of restoration efforts, success criteria will be established. These will likely include a goal of percent survivorship (e.g., 70%), a goal of total percent cover (e.g., 90%) beginning with the first annual monitoring event, and a minimum number of seeded species present. Success criteria will be identified within the restoration plan as part of the remedial design.

Vegetation planted on the cover layer will help stabilize the cover material to prevent movement into Lower Ley Creek. The final depth of soil removal and thickness of the soil cap will be refined during the pre-design phase. In addition, this alternative would require a site management plan to manage the soil cap and the remaining contamination at the site.

7.1.3.2 Monitoring and Controls

Monitoring will be conducted to evaluate the effectiveness of the restoration efforts. The monitoring program will direct maintenance as needed and document recovery of resources. Monitoring will likely occur on an annual basis for a 5-year period following the completion of restoration activities. Annual monitoring events will consist of a vegetation survey conducted using the line interception method. Annual monitoring events will be conducted in the fall. Visual meander surveys also will be conducted in the late spring/early summer to document species composition.

7.1.3.2.1 Sampling Methodology

The baseline and monitoring surveys will consist of collecting vegetative data using the line interception method (Canfield, 1941). The line interception method is a method of sampling vegetation based on the measurement of all plants intercepted by the vertical plane of a given transect. Linear measurements are then made of the intercepts of vegetation along the transect.

Because the monitoring will occur for 5 years, permanent transects will be established within the restoration area and surveyed each year. A minimum of 12 transects will be established within the riparian area, each of which will be approximately 150 ft long. Approximately six transects will be oriented parallel to Ley Creek, with three transects within the forested area and three transects within the non-forested area. The remaining six transects will be oriented perpendicular to Ley Creek.

Vegetative data collected within the survey will be used to determine percent plant cover at which plant species occur as well as species composition. This information will be compared to success criteria, established above, to evaluate the restoration's success and, if necessary, adjust management practices. The following metrics will be calculated using the vegetative data.

Absolute % Cover (Species-Specific) = Intercept Length (ft)/Transect Length (ft)*100

Total Cover = Sum of Species Specific Absolute Cover Measurements

Relative % Cover (Species-Specific) = Absolute Cover/Total Cover*100

Species Composition = Total List of Observed Species

7.1.3.2.2 Percent Survivorship

Percent survivorship is a measure of how many planted seedlings survive after planting. Because the measure is relative to individual plants, this metric is only applicable to shrubs and trees. To determine percent survivorship, the number of planted seedlings will be counted during planting and during each monitoring event. Given the size of the restoration area, counting individual trees or shrubs across the entire site will not be feasible. Accordingly, percent survivorship will be calculated from established sample plots within the restoration area. This data will be used to determine the percentage of planted seedlings that has survived. The size, location, and frequency of sample plots will be determined within the restoration plan as part of the remedial design.

7.1.3.2.3 Controls

As part of this alternative, controls will be implemented as part of a site management plan to restrict excavation and construction activities in the soil cap areas. Institutional controls could include, but would not be limited to, potential LUCs, environmental easements, deed notices, and public health advisories.

Additional controls will likely include fencing and signage. Fencing will be installed next to potential public access locations (i.e., roads) and should not significantly affect the movement of wildlife.

7.1.4 Soil-4: Soil Cap over All Contaminated Soils

Soil Alternative 4 includes the excavation or installation of a soil cap over all soils exhibiting COPCs above cleanup goals in both the Southern Swale Soil Area and the Northwest Soil Area. The extent of the excavations and soil caps in the Northwest Soil Area are shown in Figure 7.3 and the extent of the excavations and soil caps in the Southern Swale Soil Area is shown in Figure 7.4. Details on the total volume of soil to be excavated and the total volume of soil to be capped under this alternative are presented in Table 7.5.

This alternative includes excavation and off-site disposal of soils within the floodplain. However, on-site disposal may be possible at the Cooper Crouse-Hinds North Landfill or additional landfills located adjacent to Lower Ley Creek. Therefore, cost estimates for this alternative have been estimated for on-site disposal (Appendix C, Table C-1) and off-site disposal (Appendix C, Table C-3).

This alternative also includes a soil cap for some soils located in the Southern Swale Soil Area and the Northwest Soil Area. The soil cap will be a 1-ft thick layer of clean soil to isolate the contaminated soils. The soil cap will be a vegetated habitat layer. A demarcation layer (e.g., non-woven geotextile) will be installed between the contaminated soil and the soil cap. A 2-ft thick habitat layer will be placed above the soil cap and will be seeded to grow vegetation that will reduce or eliminate erosion from the areas. Vegetation in the soil cap areas will be restored, including trees and shrubs, to create a riparian buffer. Periodic reviews will be conducted at 5-year intervals to reassess the long-term appropriateness of this alternative.

In all areas, an excavation of 3 ft of soil will be completed before the soil cap is installed so there is no loss of floodplain capacity. Due to this requirement, soil caps will only be placed in areas exhibiting contamination deeper than 3 ft bgs. Any areas with contamination less than 3 ft deep will be excavated and replaced with backfill.

This soil cap serves three functions:

1. It isolates and covers the remaining contaminated soil to prevent movement.
2. It creates a clean soil surface.
3. It reduces the human health and ecological pathways for contact with contaminated soil.

It is estimated that soil RAOs will be achieved in approximately 6 months after initiation of remedial activities under Soil Alternative 4. This is based on the period of active construction required to implement this alternative.

7.1.4.1 <u>Restoration</u>

7.1.4.1.1 Baseline Sampling

Prior to remedial and restoration activities, a baseline survey will be conducted at the site. The survey will be conducted in the fall, if feasible, and will be used for comparative purposes during the monitoring phase of restoration activities. The baseline survey will include vegetation identification and data collection using the line interception method (discussed further below). In addition, permanent photo locations will be established throughout the restoration area. Photos will be taken at these locations during the baseline survey and during each of the annual monitoring events.

7.1.4.1.2 Site Restoration

Restoration activities will be initiated following the completion of remedial activities and will consist of the re-establishment of native vegetation within the disturbed area. Restoration of the riparian zone will provide erosion protection for Ley Creek associated with surface water runoff from the surrounding industrial areas. In addition, utilizing native species within the restoration activities will create native habitat within the riparian zone. Restoration activities and post-restoration monitoring activities are described below. Further details and specifications relative to site restoration will be presented in the remedial design component.

According to the Ecoregions of the United States, the historical regional vegetation for the project area consisted of native plant species typical of transitional deciduous forests between the boreal forests and broadleaf deciduous forests. The most abundant trees within this Ecoregion include oaks, maples, and beech (EPA, 2013). The site currently consists primarily of forbs and grasses near the bank of Ley Creek and a combination of forbs, grasses, woody shrubs, and deciduous forest within the riparian area.

Seeding and planting will begin as soon as possible and practicable after the completion of remedial activities. If feasible, the remedial action will be scheduled so that seeding and planting will be conducted in the spring or fall in order to maximize planting success. Species composition will be designed to reflect the existing communities of native species as well as native communities of the region, and will include a combination of trees, shrubs, forbs, and grasses. Information relative to the existing species composition will be gathered during the baseline survey. Accordingly, the desired species composition for the selection of terrestrial community composition will be finalized during the remedial design and/or after the completion of the baseline survey. Examples of likely species to be selected are listed below. The tree, shrub, and grass species are native to either the Eastern Great Lakes ecoregion and/or the state of New York (NYSDEC, 2005).

Trees: red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), red oak (*Quercus rubra*), and American beech (*Fagus grandifolia*)

Shrubs: redosier dogwood (*Cornus stolonifera*), silky dogwood (*Cornus amomum*), and highbush cranberry (*Viburnum opulus)*

Grasses: big bluestem (*Andropogon gerardii*), little bluestem (*Andropogon scoparium*), and switchgrass (*Panicum virgatum)*

The selected tree and shrub species will be planted as seedlings, likely using bare root seedlings. Trees and shrubs will be planted within the disturbed area at distances greater than an established distance (e.g., 50 ft) from the bank of Ley Creek. The seedling spacing and the type of nursery stock to be planted (e.g., bare root, ball and burlap, cuttings, etc.) will be identified within the restoration plan to be completed within the remedial design.

Grasses will be planted from seed and will be planted throughout the entire disturbed area, regardless of distance from the bank of Ley Creek. The specific mix, application rate, and type of seed application (e.g., dry seeding, hydroseeding, etc.) will be identified within the restoration plan to be completed within the remedial design.

7.1.4.1.3 Success Criteria

To evaluate the effectiveness of restoration efforts, success criteria will be established. These will likely include a goal of percent survivorship (e.g., 70%), a goal of total percent cover (e.g., 90%) beginning with the first annual monitoring event, and a minimum number of seeded species present. Success criteria will be identified within the restoration plan as part of the remedial design.

Vegetation planted on the cover layer will help stabilize the cover material to prevent movement into Lower Ley Creek. The final depth of soil removal and thickness of the soil cap will be refined during the pre-design phase. In addition, this alternative would require a site management plan to manage the soil cap and the remaining contamination at the site.

7.1.4.2 Monitoring and Controls

Monitoring will be conducted to evaluate the effectiveness of the restoration efforts. The monitoring program will direct maintenance as needed and document recovery of resources. Monitoring will likely occur on an annual basis for a 5-year period following the completion of restoration activities. Annual monitoring events will consist of a vegetation survey conducted using the line interception method. Annual monitoring events will be conducted in the fall. Visual meander surveys also will be conducted in the late spring/early summer to document species composition.

7.1.4.2.1 Sampling Methodology

The baseline and monitoring surveys will consist of collecting vegetative data using the line interception method (Canfield, 1941). The line interception method is a method of sampling vegetation based on the measurement of all plants intercepted by the vertical plane of a given transect. Linear measurements are then made of the intercepts of vegetation along the transect.

Because the monitoring will occur for 5 years, permanent transects will be established within the restoration area and surveyed each year. A minimum of 12 transects will be established within the riparian area, each of which will be approximately 150 ft long. Approximately six transects will be oriented parallel to Ley Creek, with three transects within the forested area and three transects within the non-forested area. The remaining six transects will be oriented perpendicular to Ley Creek.

Vegetative data collected within the survey will be used to determine percent plant cover at which plant species occur as well as species composition. This information will be compared to success criteria, established above, to evaluate the restoration's success and, if necessary, adjust management practices. The following metrics will be calculated using the vegetative data.

Absolute % Cover (Species-Specific) = Intercept Length (ft)/Transect Length (ft)*100

Total Cover = Sum of Species Specific Absolute Cover Measurements

Relative % Cover (Species-Specific) = Absolute Cover/Total Cover*100

Species Composition = Total List of Observed Species

7.1.4.2.2 Percent Survivorship

Percent survivorship is a measure of how many planted seedlings survive after planting. Because the measure is relative to individual plants, this metric is only applicable to shrubs and trees. To determine percent survivorship, the number of planted seedlings will be counted during planting and during each monitoring event. Given the size of the restoration area, counting individual trees or shrubs across the entire site will not be feasible. Accordingly, percent survivorship will be calculated from established sample plots within the restoration area. This data will be used to determine the percentage of planted seedlings that has survived. The size, location, and frequency of sample plots will be determined within the restoration plan as part of the remedial design.

7.1.4.2.3 Controls

As part of this alternative, controls will be implemented as part of a site management plan to restrict excavation and construction activities in the soil cap areas. Institutional controls could include, but would not be limited to, potential LUCs, environmental easements, deed notices, and public health advisories.

Additional controls will likely include fencing and signage. Fencing will be installed next to potential public access locations (i.e., roads) and should not significantly affect the movement of wildlife.

7.2 SEDIMENT REMEDIAL ALTERNATIVES

Five sediment remedial alternatives (including the No Action alternative) were developed for the Site. These alternatives are presented in Table 7.6.

To assist with the determination of remedial alternatives for sediment, the 2-mile stretch of the Lower Ley Creek Subsite has been separated into three sections (upstream, middle, and downstream) (Figure 2.5). This separation was made because the downstream section of the Site exhibits lower concentrations of contaminants and a smaller extent of contamination than the upstream or middle sections of the Site. In addition, the upstream and middle sections of the site exhibit distinctive stream characteristics. While the upstream section of Lower Ley Creek meanders, the middle section of the creek is relatively straight.

The alternatives were screened based on the criteria of effectiveness, implementability, and cost. This initial screening step was performed as required by CERCLA and the NCP to narrow the field of remedial alternatives that are subject to the detailed analysis presented in Section 8.0. The initial screening of all five sediment remedial alternatives is presented in Table 7.7. All sediment remedial alternatives passed the screening and were retained for additional evaluation.

7.2.1 Sediment-1: No Action

Sediment Alternative 1 is the No Action alternative and is presented for comparison only. The No Action Alternative consists of refraining from the active application of any remediation technology to sediments in all three sections of Lower Ley Creek. The No Action alternative also excludes source control removal action, administrative actions, and monitoring. As required by CERCLA, periodic reviews will be conducted at 5-year intervals to reassess the long-term appropriateness of continued No Action.

The RAOs for sediment will never be achieved using under this remedial alternative.

7.2.2 Sediment-2: Removal of Sediments to Cleanup Goals

This alternative includes full excavation of sediments exhibiting COPCs exceeding cleanup goals in all sections of Lower Ley Creek. Due to the relatively narrow width of the creek, the current, and the near vertical side walls of the creek channel, excavation of the sediments will be completed using land based excavators with long reach arms. Turbidity will be mitigated by the use of turbidity curtains in the creek downstream of the excavation. Stream bank restoration will be conducted after the dredging activities were completed. Where there is disturbance to the stream bank, restoration will need to include restoration of the bank with vegetation to the maximum extent possible. In areas where slopes are steep or instability is expected, bioengineering techniques to eliminate rock hardening will be used.

In the upstream, middle, and downstream sections of Lower Ley Creek, all sediments with COPCs exceeding cleanup goals will be excavated. The extent of the upstream section excavation under Sediment Alternative 2 is shown in Figure 7.5, the extent of the middle section excavation under Sediment Alternative 2 is shown in Figure 7.6, and the extent of the downstream section excavation is shown in Figure 7.7. Details on the total volume of sediment to be excavated under this alternative are presented in Table 7.8.

For this FS, it is assumed that excavation in the dry will be done in the shallower areas of Lower Ley Creek (i.e., the upstream section of Lower Ley Creek), while excavation in the wet will be completed in the deeper areas of the creek.

Excavated sediments would be transported to a SDA where they will be drained and conditioned for off-site disposal in a RCRA-compliant and, if appropriate, a TSCA-compliant disposal facility. However, on-site disposal may be possible at the Cooper Crouse-Hinds North Landfill or other landfills located adjacent to Lower Ley Creek. Therefore, cost estimates for this alternative have been estimated for on-site disposal (Appendix C, Table C-2) and off-site disposal (Appendix C, Table C-4).

An evaluation of properties around the Lower Ley Creek resulted in identification of a potential location for the SDA on the upstream section of Lower Ley Creek, just northeast of the Cooper Crouse-Hinds Landfill. Prior to the start of dredging, temporary sediment dewatering and water treatment equipment will be installed on the site. It is also recognized that portions of this site may have historical significance, therefore use of certain areas of the site have been restricted to avoid potential impact to any cultural resources that may be present on the site. The use of the dewatering and support area is temporary. Once work is completed, all equipment and improvements to the dewatering and support areas will be removed and the site will be restored.

Selection of off-site disposal facilities for the sediments will be based on the PCB concentrations in the conditioned materials. Sediments with concentrations of PCBs below 50 mg/kg will likely be accepted in local solid waste disposal facilities or in industrial waste landfills. Sediments with concentrations of PCBs greater than 50 mg/kg will be disposed of in a TSCA landfill facility.

It is estimated that sediment RAOs will be achieved in approximately 9 months after initiation of remedial activities under Sediment Alternative 2. This is based on the period of active construction required to implement this alternative.

7.2.2.1 Restoration

After excavation is completed in a particular stream area, approximately 1 ft of clean backfill would be placed to stabilize the sediment bed and support habitat replacement/reconstruction, or further isolate remaining sediments in place. Backfill configurations will be developed for each dredged section of the creek based on creek conditions such as how fast the creek flows, the type of creek bottom, residual contaminant concentrations, and habitat goals. Repair of the habitat layer will be necessary should the habitat layer be lost or damaged.

7.2.2.1.1 Baseline Sampling

Prior to remedial and restoration activities, a baseline survey will be conducted at the site. The survey will be conducted in the fall, if feasible, and will be used for comparative purposes during the monitoring phase of restoration activities. The baseline survey will include sediment composition, vegetation identification, and benthic invertebrate identification.

7.2.2.1.2 Site Restoration

Restoration activities will be initiated following the completion of remedial activities and will consist of the re-establishment habitat within the disturbed area. Further details and specifications relative to site restoration will be presented in the remedial design component.

7.2.2.2 Monitoring

Monitoring will be conducted to evaluate the effectiveness of the restoration efforts. The monitoring program will direct maintenance as needed and document recovery of resources. Monitoring will likely occur on an annual basis for a 5 year period following the completion of restoration activities. Annual monitoring events will consist of a sediment composition, vegetation survey, and benthic invertebrate survey. Annual monitoring events will be conducted in the fall.

Fish tissue sampling will be collected annually during the restoration monitoring field activities. Samples will be analyzed for metals, pesticides, PAHs, and PCBs and the resulting data will be used to monitor the effectiveness of the remedy in reducing fish tissue concentrations.

A variety of monitoring activities will be carried out on land and in the creek throughout construction of the alternative, including monitoring of water, sediments, air quality and odor, noise, lighting, and water discharged at the sediment dewatering area. Confirmation sampling will be conducted after the dredging of the sediments has been completed. No long term site management plans or institutional control will be required as part of this alternative.

7.2.2.3 Controls

Although there will be a complete removal of contaminated sediment in this alternative, there will potentially still be contaminated fish tissue. Therefore, it will be prudent to ensure that the current fish advisories for Lower Ley Creek remain in place under this alternative. However, it important to note that fish consumption advisories do not prevent human or ecological exposure to contaminated fish. The setting and maintenance of fish consumption advisories is determined by the NYSDOH.

7.2.3 Sediment-3: Granular Material Sediment Cap

This alternative includes the installation of a granular material (sand) sediment cap over portions of the upstream and middle sections of Lower Ley Creek and the excavation of contaminated sediments in portions of the upstream, middle, and downstream sections of Lower Ley Creek. The capping of the areas with sediments exhibiting COPCs exceeding cleanup goals will be completed in a manner that maintains the bathymetry of Lower Ley Creek.

In areas of the site with low erosion potential (i.e., Old Ley Creek), the granular material sediment cap includes the following design layer:

- Isolation/Habitat Layer (2 ft thick).

Based on the evaluation in Appendix E, the capping design in the upstream section of Lower Ley Creek includes the following design layers, from top to bottom:

- Habitat Layer (2 ft thick);
- Armor Layer (2.0 ft thick); and
- Isolation Layer (2 ft thick).

Based on the evaluation in Appendix E, the capping design in the middle section of Lower Ley Creek includes the following design layers, from top to bottom:

- Habitat Layer (2 ft thick);
- Armor Layer (0.3875 ft thick); and
- Isolation Layer (1.5 ft thick).

This alternative includes full excavation of sediments exhibiting COPCs exceeding cleanup goals in the downstream section of Lower Ley Creek. Due to the relatively narrow width of the creek, the current, and the near vertical side walls of the creek channel, excavation of the sediments will be completed using land based excavators with long reach arms. Turbidity will be mitigated by the use of turbidity curtains in the creek downstream of the excavation. Stream bank restoration will be conducted after the dredging activities were completed. Where there is disturbance to the stream bank, restoration will need to include restoration of the bank with vegetation to the maximum extent possible. In areas where slopes are steep or instability is expected, bioengineering techniques to eliminate rock hardening will be used. A detailed discussion of the design of the granular material sediment cap is included as Appendix E.

Before the placement of any capping material, excavation of sediment will be conducted to maintain the current bathymetry of Lower Ley Creek. Therefore, in the upstream section of Lower Ley Creek, a 6 ft excavation of sediment will be completed before the sediment cap is installed to maintain the current bathymetry of Lower Ley Creek. Due to this requirement, sediment caps will only be placed in areas exhibiting contamination deeper than 6 ft bgs in the upstream section of Lower Ley Creek. Any areas in the upstream section with contamination less than 6 ft deep will be excavated.

In the middle section of Lower Ley Creek, a 4 ft excavation of sediment will be completed before the sediment cap is installed to maintain the current bathymetry of Lower Ley Creek. Due to this requirement, sediment caps will only be placed in areas exhibiting contamination deeper than 4 ft bgs in the middle section of Lower Ley Creek. Any areas in the middle section with contamination less than 4 ft deep will be excavated.

For this FS, it is assumed that excavation in the dry will be done in the shallower areas of Lower Ley Creek (i.e., the upstream section of Lower Ley Creek), while excavation in the wet will be completed in the deeper areas of the creek.

Excavated sediments will be transported to a SDA where they would be drained and conditioned for off-site disposal in a RCRA-compliant and, if appropriate, a TSCA-compliant disposal facility. However, on-site disposal may be possible at the Cooper Crouse-Hinds North Landfill or other landfills located adjacent to Lower Ley Creek. Therefore, cost estimates for this alternative have been estimated for on-site disposal (Appendix C, Table C-2) and off-site disposal (Appendix C, Table C-4). Periodic reviews will be conducted at 5-year intervals to reassess the long-term appropriateness of this alternative.

An evaluation of properties around the Lower Ley Creek resulted in identification of a potential location for the SDA on the upstream section of Lower Ley Creek, just northeast of the Cooper Crouse-Hinds Landfill. Prior to the start of dredging, temporary sediment dewatering and water treatment equipment will be installed on the site. It is also recognized that portions of this site may have historical significance, therefore use of certain areas of the site have been restricted to avoid potential impact to any cultural resources that may be present on the site. The use of the dewatering and support area is temporary. Once work is completed, all equipment and improvements to the dewatering and support areas will be removed and the site will be restored.

Selection of off-site disposal facilities for the sediments will be based on the PCB concentrations in the conditioned materials. Sediments with concentrations of PCBs below 50 mg/kg will likely be accepted in local solid waste disposal facilities or in industrial waste landfills. Sediments with concentrations of PCBs greater than 50 mg/kg will be disposed of in a TSCA landfill facility.

The extent of the upstream section sand/armor sediment cap and excavations under Sediment Alternative 3 are shown in Figure 7.8, the extent of the middle section sand/armor sediment cap and excavations under Sediment Alternative 3 are shown in Figure 7.9, and the extent of the downstream section excavation under Sediment Alternative 3 is shown in Figure 7.7. Details on the total volume of sediment to be excavated and the total area to be capped under this alternative are presented in Table 7.9.

Old Ley Creek will only be excavated 2 ft deep before the placement of capping material because no erosional protection material is required for the Old Ley Creek Channel.

It is estimated that sediment RAOs will be achieved in approximately 9 months after initiation of remedial activities under Sediment Alternative 3. This is based on the period of active construction required to implement this alternative.

7.2.3.1 Restoration

After excavation is completed in a particular stream area, approximately 1 ft of clean backfill will be placed to stabilize the sediment bed and support habitat replacement/reconstruction, or further isolate remaining sediments in place. Backfill configurations would be developed for each dredged section of the creek based on creek conditions such as how fast the creek flows, the type of creek bottom, residual contaminant concentrations, and habitat goals. Repair of the habitat layer will be necessary should the habitat layer be lost or damaged.

7.2.3.1.1 Baseline Sampling

Prior to remedial and restoration activities, a baseline survey will be conducted at the site. The survey will be conducted in the fall, if feasible, and will be used for comparative purposes during the monitoring phase of restoration activities. The baseline survey will include sediment composition, vegetation identification, and benthic invertebrate identification.

7.2.3.1.2 Site Restoration

Restoration activities will be initiated following the completion of remedial activities and will consist of the re-establishment habitat within the disturbed area. Further details and specifications relative to site restoration will be presented in the remedial design component.

7.2.3.2 Monitoring

Monitoring will be conducted to evaluate the effectiveness of the restoration efforts. The monitoring program will direct maintenance as needed and document recovery of resources. Monitoring will likely occur on an annual basis for a 5-year period following the completion of restoration activities. Annual monitoring events will consist of a sediment composition, vegetation survey, and benthic invertebrate survey. Annual monitoring events will be conducted in the fall.

Fish tissue sampling will be collected annually during the restoration monitoring field activities. Samples will be analyzed for metals, pesticides, PAHs, and PCBs and the resulting data will be used to monitor the effectiveness of the remedy in reducing fish tissue concentrations.

A variety of monitoring activities will be carried out on land and in the creek throughout construction of the alternative, including monitoring of water, sediments, air quality and odor, noise, lighting, and water discharged at the sediment dewatering area. Confirmation sampling will be conducted after the dredging of the sediments has been completed.

7.2.3.3 Controls

As part of this alternative, controls will be implemented as part of a site management plan to restrict excavation activities in the capped sediment areas. Controls will consist of a ban on dredging in the capped/backfilled areas, signage, fencing, and ensuring that the current fish advisories for Lower Ley Creek remain in place.

However, it important to note that fish consumption advisories do not prevent human or ecological exposure to contaminated fish. The setting and maintenance of fish consumption advisories is determined by the NYS Department of Health. In addition, as Lower Ley Creek has been dredged in the past to alleviate flooding, it is possible that it may need to be dredged in the future. Therefore, a ban on dredging in the capped/backfill areas may not be feasible.

7.2.4 Sediment-4: Engineered Bentonite Sediment Cap

This alternative includes the installation of an engineered bentonite sediment cap over the upstream and middle sections of Lower Ley Creek and the excavation of contaminated sediments in the downstream section of Lower Ley Creek. The capping of the areas with sediments exhibiting COPCs exceeding cleanup goals will be completed in a manner that maintains the bathymetry of Lower Ley Creek.

The capping of the sediments in the upstream, and middle sections of Lower Ley Creek would consist of a 2.25 ft excavation and backfill with 3 inches of an engineered bentonite cap beneath 24 inches of a sand layer intended to provide additional bioturbation isolation and benthic restoration capacity. Repair of this habitat layer will be necessary should the habitat layer be lost or damaged. This alternative includes full excavation of sediments exhibiting COPCs exceeding cleanup goals in the downstream section of Lower Ley Creek. Due to the relatively narrow width of the creek, the current, and the near vertical side walls of the creek channel, excavation of the sediments would be completed using land based excavators with long reach arms. Turbidity will be mitigated by the use of turbidity curtains in the creek downstream of the excavation. Stream bank restoration will be conducted after the dredging activities were completed. Where there is disturbance to the stream bank, restoration will need to include restoration of the bank with vegetation to the maximum extent possible. In areas where slopes are steep or instability is expected, bioengineering techniques to eliminate rock hardening will be used.

This engineered bentonite sediment cap design and thickness is based on the EPA Innovative Technology Evaluation Report (EPA, 2007). Under the EPA SITE Program, the effectiveness of an engineered bentonite cap was evaluated in the Anacostia River in Washington, DC as an innovative contaminated sediment capping technology. In addition, engineered bentonite caps have been successfully deployed as a sediment remediation technology at over 10 sediment remediation project sites and evaluated at bench-scale at several others. A bentonite cap of 3 inches was used during the EPA SITE Program at the Anacostia River Project in Washington. DC. The Anacostia River is similar to Lower Ley Creek in depth and velocity; and sediments exhibited similar contaminants (PCBS, PAHs, metals) and concentrations to those found in Lower Ley Creek. The data generated during the SITE demonstration suggest that the engineered bentonite cap is highly stable. In addition, over the course of the 3-year evaluation, it appears that fine, organic-rich new sediment was deposited in the area, effectively increasing the overall thickness of the sediment cap. As in the Anacostia SITE demonstration capping project, engineered bentonite material has been successfully applied at other project sites with a two to three in application (pre-hydrated) within acceptable tolerances. As stated in the EPA SITE Report, an erosion protection layer is not required for the engineered bentonite cap due to its cohesiveness, physical stability, and impermeability.

For this FS, it is assumed that excavation in the dry will be done in the shallower areas of Lower Ley Creek (i.e., the upstream section of Lower Ley Creek), while excavation in the wet will be completed in the deeper areas of the creek.

Excavated sediments will be transported to a SDA where they would be drained and conditioned for off-site disposal in a RCRA-compliant and, if appropriate, a TSCA-compliant disposal facility. However, on-site disposal may be possible at the Cooper Crouse-Hinds North Landfill or other landfills located adjacent to Lower Ley Creek. Therefore, cost estimates for this alternative have been estimated for on-site disposal (Appendix C, Table C-2) and off-site disposal (Appendix C, Table C-4). Periodic reviews will be conducted at 5-year intervals to reassess the long-term appropriateness of this alternative.

An evaluation of properties around the Lower Ley Creek resulted in identification of a potential location for the SDA on the upstream section of Lower Ley Creek, just northeast of the Cooper Crouse-Hinds Landfill. Prior to the start of dredging, temporary sediment dewatering and water treatment equipment will be installed on the site. It is also recognized that portions of this site may have historical significance, therefore use of certain areas of the site have been restricted to avoid potential impact to any cultural resources that may be present on the site. The use of the dewatering and support area is temporary. Once work is completed, all equipment and improvements to the dewatering and support areas will be removed and the site will be restored.

Selection of off-site disposal facilities for the sediments will be based on the PCB concentrations in the conditioned materials. Sediments with concentrations of PCBs below 50 mg/kg will likely be accepted in local solid waste disposal facilities or in industrial waste landfills. Sediments with concentrations of PCBs greater than 50 mg/kg will be disposed of in a TSCA landfill facility.

This design addresses the possibility that the cap will be subject to damage from ice scour. Also, cap erosion may result from both normal river flows and less frequent, but high energy, storm events. Finally, as described further below, because substantial dredging is necessary to install an engineered cap system in shallow areas, that dredging work may expose more contaminated sediments than are currently found at the sediment surface; thus additional protection is warranted. A 24-inch benthic substrate layer will be placed over the bentonite to protect it from burrowing animals and also to provide a clean substrate for repopulation by benthic organisms.

The extent of the upstream section bentonite sediment cap under Sediment Alternative 4 is shown in Figure 7.10, the extent of the middle section bentonite sediment cap under Sediment Alternative 4 is shown in Figure 7.11, and the extent of the downstream section excavation under Sediment Alternative 4 is shown in Figure 7.7. Details on the total volume of sediment to be excavated and capped under this alternative are presented in Table 7.10.

It is estimated that sediment RAOs will be achieved in approximately 9 months after initiation of remedial activities under Sediment Alternative 4. This is based on the period of active construction required to implement this alternative.

7.2.4.1 Restoration

After excavation is completed in a particular stream area, approximately 1 ft of clean backfill will be placed to stabilize the sediment bed and support habitat replacement/reconstruction, or further isolate remaining sediments in place. Backfill configurations will be developed for each dredged section of the creek based on creek conditions such as how fast the creek flows, the type of creek bottom, residual contaminant concentrations, and habitat goals. Repair of the habitat layer will be necessary should the habitat layer be lost or damaged.

7.2.4.1.1 Baseline Sampling

Prior to remedial and restoration activities, a baseline survey will be conducted at the site. The survey will be conducted in the fall, if feasible, and will be used for comparative purposes during the monitoring phase of restoration activities. The baseline survey will include sediment composition, vegetation identification, and benthic invertebrate identification.

7.2.4.1.2 Site Restoration

Restoration activities will be initiated following the completion of remedial activities and will consist of the re-establishment habitat within the disturbed area. Further details and specifications relative to site restoration will be presented in the remedial design component.

7.2.4.2 Monitoring

Monitoring will be conducted to evaluate the effectiveness of the restoration efforts. The monitoring program will direct maintenance as needed and document recovery of resources. Monitoring will likely occur on an annual basis for a 5-year period following the completion of restoration activities. Annual monitoring events will consist of a sediment composition, vegetation survey, and benthic invertebrate survey. Annual monitoring events will be conducted in the fall.

Fish tissue sampling will be collected annually during the restoration monitoring field activities. Samples will be analyzed for metals, pesticides, PAHs, and PCBs and the resulting data will be used to monitor the effectiveness of the remedy in reducing fish tissue concentrations.

A variety of monitoring activities will be carried out on land and in the creek throughout construction of the alternative, including monitoring of water, sediments, air quality and odor, noise, lighting, and water discharged at the sediment dewatering area. Confirmation sampling will be conducted after the dredging of the sediments has been completed.

7.2.4.3 Controls

As part of this alternative, controls will be implemented as part of a site management plan to restrict excavation activities in the capped sediment areas. Controls will consist of a ban on dredging in the capped/backfilled areas, signage, fencing, and ensuring that the current fish advisories for Lower Ley Creek remain in place.

However, it important to note that fish consumption advisories do not prevent human or ecological exposure to contaminated fish. The setting and maintenance of fish consumption advisories is determined by the NYSDOH. In addition, as Lower Ley Creek has been dredged in the past to alleviate flooding, it is possible that it may need to be dredged in the future. Therefore, a ban on dredging in the capped/backfill areas may not be feasible.

7.2.5 Sediment-5: Monitored Natural Recovery

For this alternative, no active remediation will be undertaken at the Site. Naturally occurring sedimentation and microbially mediated dechlorination and degradation of PCBs – collectively referred to as natural recovery processes – will be relied upon to further reduce risk in the Lower Ley Creek over time.

A 30-year monitoring program will be developed and implemented. Likely components to the program will include periodic monitoring of the water column and fish in Lower Ley Creek. The monitoring program will be reviewed, at a minimum, every 5 years to assess whether modifications were warranted. It is anticipated that fish consumption advisories will remain in place until the NYSDOH determines the advisories are no longer needed.

7.2.5.1 Baseline Sampling

Prior to monitoring activities, a baseline survey will be conducted at the site. The survey will be conducted in the fall, if feasible, and will be used for comparative purposes during the monitoring phase. The baseline survey will include sediment composition, vegetation identification, and benthic invertebrate identification.

7.2.5.2 Monitoring

Monitoring will be conducted to evaluate the effectiveness of the natural recovery of Lower Ley creek. Monitoring will likely occur on an annual basis for a 30-year period. Annual monitoring events will consist of a sediment composition, vegetation survey, and benthic invertebrate survey. Annual monitoring events will be conducted in the fall.

Fish tissue sampling will be collected annually during the monitoring field activities. Samples will be analyzed for metals, pesticides, PAHs, and PCBs and the resulting data will be used to monitor the effectiveness of the remedy in reducing fish tissue concentrations.

7.2.5.3 Controls

Controls would consist of signage, fencing, and ensuring that the current fish advisories for Lower Ley Creek remain in place.

However, it important to note that fish consumption advisories do not prevent human or ecological exposure to contaminated fish. The setting and maintenance of fish consumption advisories is determined by the NYSDOH.

8.0 REMEDIAL ALTERNATIVE EVALUATION

This section presents a detailed description and analysis of each remedial alternative that passed the effectiveness, implementability, and cost screening evaluation in Tables 7.2 and 7.6. Four soil remedial alternatives and four sediment remedial alternatives were retained for detailed analysis. Section 8.1 provides a summary of the detailed analysis process, the nine criteria used to analyze each remedial alternative, and the manner in which these criteria are applied in this FS. Sections 8.2 and 8.3 present the detailed analyses of these alternatives.

8.1 EVALUATION PROCESS AND EVALUATION CRITERIA

The NCP provides nine key criteria to address the CERCLA requirements for analysis of remedial alternatives. The first two criteria are threshold criteria that must be met by each alternative. The next five criteria are the primary balancing criteria upon which the analysis is based. The final two criteria are referred to as modifying criteria and are applied, following the public comment period, to evaluate state and community acceptance.

The two **threshold criteria** are:

- Overall Protection of Human Health and the Environment; and
- Compliance with ARARs.

The five **primary balancing criteria** upon which the analysis is based are:

- Long-Term Effectiveness and Permanence;
- Reduction of Toxicity, Mobility or Volume through Treatment;
- Short-Term Effectiveness;
- Implementability; and
- Cost.

The two **modifying criteria** are:

- State Acceptance; and
- Community Acceptance.

Seven of these nine criteria are described below and employed in the detailed evaluation of alternatives for remediation of Lower Ley Creek. State acceptance will be addressed by EPA in the Proposed Plan and ROD, respectively. Community acceptance will be addressed in the ROD. The detailed evaluation of the soil remedial alternatives for Lower Ley Creek are discussed in Section 8.2 and presented in Table 8.1. The detailed evaluation of the sediment remedial alternatives for Lower Ley Creek are discussed in Section 8.3 and presented in Table 8.2. It must be stressed that the alternatives described in the following analyses are conceptual. Any characteristics of these alternatives (such as remediation locations, depths, and removal/capping rates), while based on the available data and information, should be considered preliminary.

8.1.1 Overall Protection of Human Health and the Environment

This evaluation criterion provides a final assessment as to whether each alternative adequately protects human health and the environment, and draws on the assessments conducted under other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs. As part of determination of protectiveness, the evaluation describes how risks through each pathway would be eliminated, reduced, or controlled through treatment, engineering, or institutional controls.

8.1.2 Compliance with ARARs

Alternatives are assessed as to whether they attain federal and state ARARs including:

- Chemical-specific ARARs;
- Location-specific ARARs;
- Action-specific ARARs; and
- Other criteria, advisories, and guidelines, as appropriate.

EPA may select a remedial action that does not attain a particular ARAR under certain conditions outlined in CERCLA Section 121(d) and the NCP. Preliminary ARARs are provided in Appendix A. There are no chemical-specific ARARs for sediments. However, there are TBC values (i.e., NYSDEC sediment screening values).

8.1.3 Long-Term Effectiveness and Permanence

Alternatives are also assessed for the long-term effectiveness and permanence they afford, and the degree of certainty that the alternative will prove successful. Factors that can be considered, according to the NCP and RI/FS Guidance, are as follows:

- Long-term reliability and adequacy of the engineering and institutional controls, including uncertainties associated with land disposal of untreated wastes and residuals; and
- Magnitude of residual risks in terms of amounts and concentrations of wastes remaining following implementation of a remedial action, considering the persistence, toxicity, mobility, and propensity to bioaccumulate of such hazardous substances and their constituents.

8.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

CERCLA expresses a preference for remedial alternatives employing treatment that reduces the toxicity, mobility, or volume of hazardous substances. Relevant factors include:

- The treatment processes that the remedies employ and the materials they will treat;
- The amount of hazardous materials that will be destroyed or treated;
- The degree of expected reduction in toxicity, mobility, or volume;

- The degree to which the treatment is irreversible;
- The type and quantity of residuals that will remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate of such hazardous substances and their constituents; and
- Whether the alternative would satisfy the statutory preference for treatment as a principal element.

8.1.5 Short-Term Effectiveness

The short-term effectiveness of alternatives is assessed considering such appropriate factors as:

- Protection of the community during remedial actions;
- Protection of the workers during remedial actions;
- Potential adverse environmental impacts resulting from construction and implementation; and
- Time until remedial response objectives (i.e., RAOs and PRGs) are achieved.

For the purposes of this FS, the short-term period is considered to include the time from initiation of remedial activities, assumed to be in the year 2014, through the alternative-specific and creek section-specific period for implementation, and a subsequent 1- to 2-year period for attenuation of residual impacts.

8.1.6 Implementability

The ease or difficulty of implementing the alternatives is assessed by considering the following factors:

- Technical Feasibility
  - Degree of difficulty associated with constructing and operating the technology;
  - Expected operational reliability of the technologies;
  - Ease of undertaking additional remedial actions, if necessary; and
  - Ability to monitor the effectiveness of the alternative.
- Administrative Feasibility
  - Need to coordinate with and obtain necessary approvals and permits from other agencies and offices.
- Availability of Services and Materials
  - Availability of necessary equipment and specialists;
  - Availability of adequate capacity and location of needed treatment, storage, and disposal services;
  - Availability of prospective technologies; and
  - Availability of services and materials, plus the potential for obtaining competitive bids.

8.1.7 Cost

Costs for CERCLA evaluation are divided into two principal categories: 1) capital costs, and 2) annual operations and maintenance (O&M) costs. A number of principal elements of a remedial alternative may fall into the category of direct and indirect capital costs:

- Construction costs;
- Equipment costs;
- Site development costs;
- Building and services costs;
- Transport and disposal costs;
- Engineering expenses;
- Startup and shakedown costs; and
- Contingency allowances.

Those items not placed into the capital cost category are considered to be O&M costs, among which are the following:

- Operating labor costs;
- Materials and energy costs;
- Purchased services;
- Administrative and insurance costs; and
- Costs of periodic site reviews.

The estimated costs for each alternative included:

- Capital costs, including both direct and indirect costs;
- Annual operations and maintenance costs; and
- Net present value of capital and O&M costs.

Total estimated costs for each remedial alternative are calculated and presented in Appendix C. The remedial alternative cost estimates were developed using cost estimating guides, unit cost estimates from similar projects, and Air Force Civil Engineer Center (AFCEC) Remedial Action Cost Engineering and Requirements (RACER™) software. These estimates are based on the estimated quantities for each alternative and are considered accurate to -30 percent to + 50 percent.

8.1.8 State Acceptance

This criterion provides the state - in this case, NYS - with the opportunity to assess any technical or administrative issues and concerns regarding each of the alternatives. State acceptance will be addressed by EPA in the Proposed Plan and ROD, respectively.

8.1.9 Community Acceptance

Issues and concerns the public may have regarding each of the alternatives falls into this category of evaluation. Community acceptance will be addressed in the ROD.

8.2 SOIL REMEDIAL ALTERNATIVES

8.2.1 Soil-1: No Action

8.2.1.1 Overall Protection of Human Health and the Environment

The No Action alternative would not be protective of human health and the environment, because this would not actively address the contaminated soils that present unacceptable risks of exposure to receptors or the release and transport of COPCs at the site. The RAOs or cleanup goals would not be met under this alternative.

8.2.1.2 Compliance with ARARs

The No Action alternative would not meet chemical-specific ARARs (i.e., RCRA, Clean Water Act [CWA], etc.) for soils and would not be in compliance with TSCA.

8.2.1.3 Long-Term Effectiveness and Permanence

The No Action alternative would not be effective in meeting the RAOs and PRGs and would not be effective in addressing risks to human health and the environment. The dominant carcinogenic and non-carcinogenic risks to human health and ecological receptors posed by the contaminated soils would continue for several decades under this alternative. This alternative would not effectively eliminate the potential exposure to contaminants in soil.

8.2.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

The toxicity and volume of COPCs in soil would not be significantly reduced under the No Action alternative because no treatment would be conducted. The overall bioavailability and mobility of contaminants in the soil may be reduced over time as some natural recovery processes occur.

8.2.1.5 Short-Term Effectiveness

The No Action alternative does not include any physical construction measures in any areas of contamination and, therefore, would not present any potential adverse impacts to the community or workers as a result of its implementation.

8.2.1.6 Implementability

The complete deferral of RA would be easily implemented from both technical and administrative standpoints, as it would only require periodic re-evaluation (every 5 years) of risks to human health and environment.

8.2.1.7 <u>Cost</u>

The costs for this alternative are minimal and include no capital costs and only minimal project management and reporting costs annually and for 5-year reviews. The total present worth of this alternative is approximately $50,000. A cost breakdown is provided in Appendix C.

8.2.1.8 <u>State Acceptance</u>

Not evaluated.

8.2.1.9 <u>Community Acceptance</u>

Not evaluated.

8.2.1.10 <u>Conclusion</u>

The No Action alternative would not actively reduce the toxicity, mobility, or volume of the contamination through treatment. The cancer risks and non-cancer human health hazards and risks to ecological receptors would continue to remain above acceptable levels and the surface water quality would continue to be degraded.

8.2.2 Soil-2: Excavation of Soil to Meet Cleanup Goals

8.2.2.1 <u>Overall Protection of Human Health and Environment</u>

Excavation to remove impacted soils would provide protection of human health and the environment by eliminating the exposure pathways associated with impacted soils. Removal of all contaminated soils would eliminate future potential COPC releases to the creek.

Capping contaminated soils would provide overall protection of human health and the environment by eliminating the potential human health and ecological exposure pathways associated with impacted soils. Clean cap material would prevent direct exposure of humans and ecological receptors to contaminated soil. Erosion control measures on the cap would reduce or eliminate the potential COPC releases to the creek.

8.2.2.2 <u>Compliance with ARARs</u>

This alternative would comply with chemical-specific, location-specific and action-specific ARARs (i.e., RCRA, CWA, etc.). Soil caps are routinely installed in compliance with ARARs. This alternative would also be in compliance with TSCA.

8.2.2.3 <u>Long-Term Effectiveness and Permanence</u>

Removal and off-site disposal/treatment of contaminated soil is a permanent remedy for Lower Ley Creek soils. Soil excavation is a reliable technology and properly managed landfills provide reliable controls for long-term management of contaminated soils.

Utilization of a soil cap is a proven technology for isolating contaminated soils from erosion and transport to the creek and biota if proper design, placement, and maintenance of the cap are performed to provide cap effectiveness, continued performance, and reliability. In addition, controls as part of a site management plan would be implemented to restrict excavation and construction activities in the soil cap areas. The soil cap would reduce the mobility of contaminants in the soil but would not affect toxicity or volume of contaminants in the soil or sediments. Because contamination remains in the soil, a soil cap may be inherently less protective of human health and the environment in the long term than removal alternatives. Even though the soil cap concept is designed to avoid failure, damage caused during catastrophic natural events like major floods cannot be avoided. Damaged cap materials would be repaired and/or replaced as needed following major natural or man-made events.

As part of this alternative, controls would be implemented as part of a site management plan to restrict excavation and construction activities in the soil cap areas. Controls associated with a soil cap would include signage, fencing, and potential LUCs. The use of multiple controls for this alternative should increase their effectiveness.

This alternative would provide long-term effectiveness and permanence by eliminating the potential human health and ecological exposure pathways associated with impacted soil. A site management plan would be implemented to confirm that the soil cap remains effective over time.

8.2.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Removal of contaminated soils would result in reducing the toxicity, mobility, and volume of the soil. The greater the volume of soil removed, the greater the reduction in toxicity, mobility and volume of COPCs. Capping relies on isolation rather than treatment to achieve effectiveness. Natural processes that reduce toxicity such as biological degradation of organic compounds would continue to occur beneath the soil cap following construction, although these processes may be insignificant.

8.2.2.5 Short-Term Effectiveness

Physical construction of this alternative could likely be completed in approximately one construction season. The effects of this alternative during the construction and implementation phase would potentially include:

- Impact to local property owners during soil removals and capping;
- Impact to local pipelines during soil removals and capping;
- Additional potential risk presented by volatilization of organics during excavation and materials handling;
- Potential for increased stormwater runoff and erosion during excavation activities;
- The off-site transport of contaminated soil could potentially adversely affect local traffic and may pose the potential for traffic accidents, which in turn could result in releases of hazardous substances;
- Potential for on-site worker and transportation accidents associated with remedial construction; and

- Potential for on-site workers to receive adverse impacts through dermal contact with contaminated soil.

Excavation and contaminated media handling may create air emissions and odors through release of SVOCs and VOCs from the removed materials. However, due to the low levels of VOCs in Lower Ley Creek, significant odors and air emissions are not expected and odor controls will not be necessary during remediation activities. Appropriate measures would be taken to minimize any adverse impacts from soil excavation activities, including measures to prevent transport of fugitive dust and exposure of workers and downgradient receptors to contamination. All of the short-term impacts discussed above can be minimized or mitigated by exercising sound engineering practices, following appropriate health and safety protocols, wearing proper personal protective equipment (PPE), and adequate monitoring.

8.2.2.6 Implementability

Appropriate soil excavation and capping technologies are readily available and implementable, and construction procedures are well established. Excavation and capping have been demonstrated as effective remedial technologies for impacted soils at numerous sites. The technology, equipment, subcontractors, personnel, and facilities required to successfully excavate or cap contaminated soils are available in the environmental market place. Guidance documents are also available from numerous sources, including the EPA and the USACE, on how to successfully design, construct, and monitor soil cap projects. Short-term and long-term monitoring as part of a site management plan can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken should the alternative prove to be ineffective or partially ineffective although greater removal volumes would require either longer durations or additional dredging and excavation equipment. The presence of two large buried pipelines in the Northwest Soils area may limit the removal of contaminated soils in that vicinity. Therefore, in those areas, a soil cap will be installed above contaminated soil that could not be excavated.

8.2.2.7 Cost

8.2.2.7.1 On-site Disposal

This soil alternative had the highest construction and overall costs among the alternatives evaluated. The substantial volume of excavation would cost approximately $6.8 million. The annual operation, maintenance, management and reporting costs would be the lowest of the alternatives. Total present worth is approximately $10 million for this alternative. A detailed cost breakdown is provided in Appendix C, Table C-1.

8.2.2.7.2 Off-site Disposal

This soil alternative had the highest construction and overall costs among the alternatives evaluated. The substantial volume of excavation would cost approximately $12.8 million. The annual operation, maintenance, management and reporting costs would be the lowest of the alternatives. Total present worth is approximately $18.4 million for this alternative. A detailed cost breakdown is provided in Appendix C, Table C-3.

8.2.2.8 State Acceptance

Not evaluated.

8.2.2.9 Community Acceptance

Not evaluated.

8.2.2.10 Conclusion

This alternative significantly reduces the risks to human health and the environment from soil contamination at the site. This conclusion is based on a combination of factors that includes the area remediated and the volume of soils removed. This is the most extensive soil remedial alternative, and as such provides the greatest benefits at the highest costs. It serves as the upper bound of the benefits of active remediation of soils at Lower Ley Creek.

8.2.3 Soil-3: Excavation of Southern Swale Soils to Meet Cleanup Goals and Soil Cap for Northwest Soils

8.2.3.1 Overall Protection of Human Health and Environment

Excavation to remove impacted soils would provide protection of human health and the environment by eliminating the exposure pathways associated with impacted soils. Removal of contaminated soils would reduce future potential COPC releases to the creek.

Capping contaminated soils would provide overall protection of human health and the environment by eliminating the potential human health and ecological exposure pathways associated with impacted soils. Clean cap material would prevent direct exposure of humans and ecological receptors to contaminated soil. Erosion control measures on the cap would reduce or eliminate the potential COPC releases to the creek.

8.2.3.2 Compliance with ARARs

This alternative would comply with chemical-specific, location-specific and action-specific ARARs (i.e., RCRA, CWA, etc.). Soil caps are routinely installed in compliance with ARARs. This alternative would also be in compliance with TSCA.

8.2.3.3 Long-Term Effectiveness and Permanence

Removal and off-site disposal/treatment of contaminated soil is a permanent remedy for Lower Ley Creek soils. Soil excavation is a reliable technology and properly managed landfills provide reliable controls for long-term management of contaminated soils.

Utilization of a soil cap is a proven technology for isolating contaminated soils from erosion and transport to the creek and biota if proper design, placement, and maintenance of the cap are performed to provide cap effectiveness, continued performance, and reliability. In addition, controls as part of a site management plan would be implemented to restrict excavation and construction activities in the soil cap areas. The soil cap would reduce the mobility of contaminants in the soil but would not affect toxicity or volume of contaminants in the soil or sediments. Because contamination remains in the soil, a soil cap may be inherently less protective of human health and the environment in the long term than removal alternatives. Even though the soil cap concept is designed to avoid failure, damage caused during catastrophic natural events like major floods cannot be avoided. Damaged cap materials would be repaired and/or replaced as needed following major natural or man-made events.

As part of this alternative, controls would be implemented as part of a site management plan to restrict excavation and construction activities in the soil cap areas. Controls associated with a soil cap would include signage, fencing, and potential LUCs. The use of multiple institutional controls for this alternative should increase their effectiveness.

8.2.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Removal of contaminated soils would result in reducing the toxicity, mobility, and volume of the soil. The greater the volume of soil removed, the greater the reduction in toxicity, mobility and volume of COPCs. Capping relies on isolation rather than treatment to achieve effectiveness. Natural processes that reduce toxicity such as biological degradation of organic compounds would continue to occur beneath the soil cap following construction, although these processes may be insignificant.

8.2.3.5 Short-Term Effectiveness

Physical construction of this alternative could likely be completed in approximately one construction season. The effects of this alternative during the construction and implementation phase would potentially include:

- Impact to local property owners during soil removals and capping;
- Impact to local pipelines during soil removals and capping;
- Additional potential risk presented by volatilization of organics during excavation and materials handling;
- Potential for increased stormwater runoff and erosion during excavation activities;
- The off-site transport of contaminated soil could potentially adversely affect local traffic and may pose the potential for traffic accidents, which in turn could result in releases of hazardous substances.
- Potential for on-site worker and transportation accidents associated with remedial construction; and
- Potential for on-site workers to receive adverse impacts through dermal contact with contaminated soil.

Excavation and contaminated media handling may create air emissions and odors through release of SVOCs and VOCs from the removed materials. However, due to the low levels of VOCs in Lower Ley Creek, significant odors and air emissions are not expected and odor controls will not be necessary during remediation activities. Appropriate measures will be taken to minimize any adverse impacts from soil excavation activities, including measures to prevent transport of fugitive dust and exposure of workers and downgradient receptors to contamination. All of the short-term impacts discussed above would be minimized or mitigated by exercising sound engineering practices, following appropriate health and safety protocols, wearing proper PPE, and adequate monitoring.

8.2.3.6 Implementability

No administrative difficulties are anticipated in getting the necessary approvals from EPA, USACE, and NYSDEC for soil removal and the installation of a soil cap.

Appropriate soil excavation and capping technologies are readily available and implementable, and construction procedures are well established. There appears to be property available for the land-support areas that would be required for excavation of soils and the installation of a soil cap. Excavation and capping have been demonstrated as effective remedial technologies for impacted soils at numerous sites. The technology, equipment, subcontractors, personnel, and facilities required to successfully excavate or cap contaminated soils are available in the environmental market place. Guidance documents are also available from numerous sources, including the EPA and the USACE, on how to successfully design, construct, and monitor soil cap projects. Short-term and long-term monitoring as part of a site management plan can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken should the alternative prove to be ineffective or partially ineffective although greater removal volumes would require either longer durations or additional dredging and excavation equipment.

8.2.3.7 Cost

8.2.3.7.1 On-site Disposal

This soil alternative had the second highest construction and overall costs among the alternatives evaluated. The substantial volume of excavation would cost approximately $6.7 million. Total present worth is approximately $9.9 million for this alternative. A detailed cost breakdown is provided in Appendix C, Table C-1.

8.2.3.7.2 Off-site Disposal

This soil alternative had the second highest construction and overall costs among the alternatives evaluated. The substantial volume of excavation would cost approximately $12.6 million. Total present worth is approximately $18.2 million for this alternative. A detailed cost breakdown is provided in Appendix C, Table C-3.

8.2.3.8 State Acceptance

Not evaluated.

8.2.3.9 Community Acceptance

Not evaluated.

8.2.3.10 Conclusion

This alternative significantly reduces the risks to human health and the environment from soil contamination at the site. This conclusion is based on a combination of factors that includes the area remediated and the volume of soils removed. This is the next most extensive and expensive soil remedial alternative after Soil Alternative 2. This alternative appears to provide a good balance in achieving the RAOs and cleanup goals at costs that are more moderate as compared to Soil Alternative 2. This alternative also addresses the most contaminated soils at the Site.

8.2.4 Soil-4: Soil Cap Over All Contaminated Soils

8.2.4.1 Overall Protection of Human Health and Environment

Capping contaminated soils would provide overall protection of human health and the environment by eliminating the potential human health and ecological exposure pathways associated with impacted soils. Clean cap material would prevent direct exposure of humans and ecological receptors to contaminated soil. Erosion control measures on the cap would reduce or eliminate the potential COPC releases to the creek.

8.2.4.2 Compliance with ARARs

This alternative would comply with chemical-specific, location-specific and action-specific ARARs (i.e., RCRA, CWA, etc.). Soil caps are routinely installed in compliance with ARARs. This alternative would also be in compliance with TSCA.

8.2.4.3 Long-Term Effectiveness and Permanence

Utilization of a soil cap is a proven technology for isolating contaminated soils from erosion and transport to the creek and biota if proper design, placement, and maintenance of the cap are performed to provide cap effectiveness, continued performance, and reliability. In addition, controls as part of a site management plan would be implemented to restrict excavation and construction activities in the soil cap areas. The soil cap would reduce the mobility of contaminants in the soil but would not affect toxicity or volume of contaminants in the soil or sediments. Because contamination remains in the soil, a soil cap may be inherently less protective of human health and the environment in the long term than removal alternatives. Even though the soil cap concept is designed to avoid failure, damage caused during catastrophic natural events like major floods cannot be avoided. Damaged cap materials would be repaired and/or replaced as needed following major natural or man-made events.

As part of this alternative, controls would be implemented as part of a site management plan to restrict excavation and construction activities in the soil cap areas. Controls associated with a soil cap would include signage, fencing, and potential LUCs. The use of multiple controls for this alternative should increase their effectiveness.

This alternative would provide long-term effectiveness and permanence by eliminating the potential human health and ecological exposure pathways associated with impacted soil.

8.2.4.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Capping relies on isolation rather than treatment to achieve effectiveness. Natural processes that reduce toxicity such as biological degradation of organic compounds would continue to occur beneath the soil cap following construction, although these processes may be insignificant.

8.2.4.5 Short-Term Effectiveness

Physical construction of this alternative could likely be completed in approximately one construction season. The effects of this alternative during the construction and implementation phase would potentially include:

- Impact to local property owners during soil capping;
- Impact to local pipelines during soil removals and capping;
- Additional potential risk presented by volatilization of organics during excavation and materials handling;
- Potential for increased stormwater runoff and erosion during activities;
- Potential for on-site worker and transportation accidents associated with remedial construction; and
- Potential for on-site workers to receive adverse impacts through dermal contact with contaminated soil.

Based on experience at other soil capping sites, the impacts are not anticipated to be significant. Proven, available engineering controls would be employed during the soil cap implementation. In addition, steps would be taken to minimize the impact to local property owners during the soil capping process. Appropriate measures would be taken to minimize any adverse impacts from soil excavation and capping activities, including measures to prevent transport of fugitive dust and exposure of workers and downgradient receptors to contamination. All of the short-term impacts discussed above would be minimized or mitigated by exercising sound engineering practices, following appropriate health and safety protocols, wearing proper PPE, and adequate monitoring.

8.2.4.6 Implementability

No administrative difficulties are anticipated in getting the necessary approvals from EPA, USACE, and NYSDEC for the installation of a soil cap.

Appropriate soil capping technologies are readily available and implementable, and construction procedures are well established. There appears to be property available for the land-support areas that would be required for the installation of a soil cap. Soil capping has been demonstrated as an effective remedial technology for impacted soils at numerous sites. The technology, equipment, subcontractors, personnel, and facilities required to successfully excavate or cap contaminated soils are available in the environmental market place. Guidance documents are also available from numerous sources, including the EPA and the USACE, on how to successfully design, construct, and monitor soil cap projects. Short-term and long-term monitoring as part of a site management plan can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken should the alternative prove to be ineffective.

8.2.4.7 <u>Cost</u>

8.2.4.7.1 On-site Disposal

This soil alternative had the lowest construction and overall costs among the active alternatives evaluated. Total present worth is approximately $8.6 million for this alternative. A detailed cost breakdown is provided in Appendix C, Table C-1.

8.2.4.7.2 Off-site Disposal

This soil alternative had the lowest construction and overall costs among the alternatives evaluated. Total present worth is approximately $15.8 million for this alternative. A detailed cost breakdown is provided in Appendix C, Table C-3.

8.2.4.8 <u>State Acceptance</u>

Not evaluated.

8.2.4.9 <u>Community Acceptance</u>

Not evaluated.

8.2.4.10 <u>Conclusion</u>

This alternative significantly reduces the risks to human health and the environment from soil contamination at the site. As with Soil Alternative 3, this alternative appears to provide a good balance in achieving the RAOs and cleanup goals at costs that are more moderate as compared to Soil Alternative 2.

8.3 SEDIMENT REMEDIAL ALTERNATIVES

8.3.1 Sediment-1: No Action

8.3.1.1 <u>Overall Protection of Human Health and the Environment</u>

The No Action alternative would not be protective of human health and the environment, because this would not actively address the contaminated sediments that present unacceptable risks of exposure to receptors or the release and transport of COPCs at the site. The RAOs or cleanup goals would not be met under this alternative.

8.3.1.2 <u>Compliance with ARARs</u>

There are no chemical-specific ARARs (i.e., RCRA, CWA, etc.) for sediments. However, there are TBC values (i.e., NYSDEC sediment screening values). The No Action alternative would not meet these TBCs. This alternative would also not be in compliance with TSCA.

8.3.1.3 Long-Term Effectiveness and Permanence

The No Action alternative does not provide significant long-term effectiveness. The No Action alternative would not be effective in meeting the RAOs and cleanup goals and would not be effective in addressing risks to human health and the environment. The dominant carcinogenic and non-carcinogenic risks to human health and ecological receptors posed by the contaminated sediments would continue for several decades under this alternative. The creek would be expected to continue to improve naturally over time. However, it would not effectively eliminate the potential exposure to contaminants in sediment. The rate of improvement is unpredictable and would not be verified due to the lack of monitoring under this alternative.

8.3.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

The toxicity and volume of COPCs in sediment would not be significantly reduced under the No Action alternative because no treatment would be conducted. The overall bioavailability and mobility of contaminants in the sediment may be reduced over time as some natural recovery processes occur.

8.3.1.5 Short-Term Effectiveness

The No Action alternative does not include any physical construction measures in any areas of contamination and, therefore, would not present any potential adverse impacts to the community or workers as a result of its implementation.

8.3.1.6 Implementability

The complete deferral of remedial action would be easily implemented from both technical and administrative standpoints, as it would only require periodic re-evaluation (every 5 years) of risks to human health and environment.

8.3.1.7 Cost

The costs for this alternative are minimal and include no capital costs and only minimal project management and reporting costs annually and for 5-year reviews. The total present worth of this alternative is approximately $50,000. A costs breakdown is provided in Appendix C.

8.3.1.8 State Acceptance

Not evaluated.

8.3.1.9 Community Acceptance

Not evaluated.

8.3.1.10 Conclusion

The No Action alternative would not actively reduce the toxicity, mobility, or volume of the contamination through treatment. The cancer risks and non-cancer human health hazards and risks to ecological receptors posed by fish consumption would continue to remain above acceptable levels and the surface water quality would continue to be degraded.

8.3.2 Sediment-2: Removal of All Sediments to Cleanup Goals

8.3.2.1 Overall Protection of Human Health and the Environment

Excavation to remove all impacted sediments would provide protection of human health and the environment by eliminating the exposure pathways associated with impacted sediments. Backfilling with clean fill would provide habitat for benthic species to colonize.

8.3.2.2 Compliance with ARARs

There are no chemical-specific ARARs (i.e., RCRA, CWA, etc.) for sediments. However, there are TBC values (i.e., NYSDEC sediment screening values). Sediment removal would comply with TBCs. The excavation and backfilling work may result in short-term localized exceedences of surface water criteria due to suspension of impacted sediment during excavation. However, the water quality impacts from excavation would meet the substantive water quality requirements imposed by NYS on entities seeking a dredged material discharge permit under Section 404 of the CWA. This alternative would also be in compliance with TSCA.

8.3.2.3 Long-Term Effectiveness and Permanence

The removal and off-site disposal/treatment of contaminated sediments is a permanent remedy for the Site. Sediment excavation is a reliable technology. Removal of sediments would reduce toxicity, volume, and mobility of contaminants in the creek. Properly managed landfills provide reliable controls for long-term management of contaminated sediments. Treatability studies may be required to demonstrate the effectiveness of specific technologies in treating sediments from Lower Ley Creek.

This alternative would provide long-term effectiveness and permanence by eliminating the potential human health and ecological exposure pathways associated with impacted sediment.

8.3.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Excavation processes would result in reducing the toxicity, mobility, and volume of the sediment. Treatment of water resulting from the excavation would reduce the toxicity, mobility and volume of COPCs that are mobilized from the sediment into the water stream. The greater the volume of sediment removed, the greater the reduction in toxicity, mobility and volume that would result from these processes.

8.3.2.5 Short-Term Effectiveness

Sediment removal may result in short-term adverse impacts to the creek. These impacts include exposure of contaminated sediments to the water column, fish, and biota due to resuspension of sediments during removal and temporary loss of benthos and habitat for the ecological community in dredged areas. Risks due to resuspension can be minimized through control of sediment removal rate and use of an appropriate sediment cap. Replacement of the benthic habitat would be implemented through addition of a layer of backfill material in excavated areas after sediment removal. Natural benthic recolonization following a disturbance is rapid, and in many instances, the process begins within days after perturbation.

Physical construction of this alternative could likely be completed in approximately two construction seasons. The effects of this alternative during the construction and implementation phase would potentially include:

- Impact to local property owners during sediment removals;
- Temporary loss of creek habitat;
- Temporary impacts of resuspension of COPCs and potential release into the water column during excavation;
- Additional potential risk presented by volatilization of organics during excavation and materials handling;
- The off-site transport of contaminated sediment could potentially adversely affect local traffic and may pose the potential for traffic accidents, which in turn could result in releases of hazardous substances.
- Potential for on-site worker and transportation accidents associated with remedial construction; and
- Potential for on-site workers to receive adverse impacts through dermal contact with contaminated sediment.

Excavation, contaminated media handling, and dewatering may create air emissions and odors through release of SVOCs and VOCs from the removed materials. However, due to the low levels of VOCs in Lower Ley Creek, significant odors and air emissions are not expected and odor controls will not be necessary during remediation activities. All of the short-term impacts discussed above would be minimized or mitigated by exercising sound engineering practices, following appropriate health and safety protocols, wearing proper PPE, and adequate monitoring.

8.3.2.6 Implementability

Equipment and services for sediment removal are available commercially, as are equipment and services for material handling and off-site transportation. In some areas, specialized excavation equipment may be required. However, most excavators would be able to dig at least 15 ft bwsi from the edge of the creek. The potentially large volume of sediments to be removed would require significant coordination of the excavation efforts, material handling activities, and off-site transportation logistics. There is sufficient, currently available, off-site land disposal capacity for both the TSCA-regulated and non-TSCA-regulated fractions of removed sediment. In addition, there appears to be property available for the land-support areas that would be required for excavation of sediments.

No administrative difficulties are anticipated in getting the necessary approvals from EPA, USACE, and NYSDEC for sediment removal. However, the sediment removal activities will result in temporary disruption of local businesses during remediation. The difficulty associated with this disruption is a function both of the total length of shoreline disruption and the value of the disturbed area. Although measures to mitigate or prevent impacts and disruptions would be employed, the local community would experience some measure of inconvenience during remedial activities. Measures that would be implemented in conjunction with this alternative category to minimize both short- and long-term disruption include:

- Limited duration of the remediation period (a matter of months at any given location);
- Shoreline stabilization and waterfront restoration;
- Control of sediment removal rates; and
- Use of sediment barriers during sediment removal.

Excavation has been demonstrated as an effective remedial technology for impacted sediments at numerous sites. Guidance documents are also available from numerous sources, including the EPA and the USACE, on how to successfully design, construct, and monitor excavation projects. The technology, equipment, subcontractors, personnel, and facilities required to successfully complete this alternative are available in the environmental market place. Short-term and long-term monitoring of this alternative can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken should the alternative prove to be ineffective or partially ineffective although greater removal volumes would require either longer durations or additional excavation equipment.

8.3.2.7 <u>Cost</u>

8.3.2.7.1 On-site Disposal

This alternative had the third lowest construction costs and overall costs among the alternatives evaluated. The excavation would cost approximately $4.6 million. The annual operation, maintenance, management and reporting costs are the lowest of all the action alternatives. Total present worth is approximately $7.8 million for this alternative. A detailed cost breakdown is provided in Appendix C, Table C-2.

8.3.2.7.2 Off-site Disposal

This alternative had the highest construction costs and highest overall costs among the alternatives evaluated. The excavation would cost approximately $11.3 million. The annual operation, maintenance, management and reporting costs are the lowest of all the action alternatives. Total present worth is approximately $16.5 million for this alternative. A detailed cost breakdown is provided in Appendix C, Table C-4.

8.3.2.8 <u>State Acceptance</u>

Not evaluated.

8.3.2.9 <u>Community Acceptance</u>

Not evaluated.

8.3.2.10 Conclusion

This alternative significantly reduces the risks to human health and the environment from contaminants at the site. This conclusion is based on a combination of factors that includes the area remediated, the volume of sediments removed, and the length of creek affected. The sediment excavation alternative is the most extensive remedial alternative, and as such provides the greatest benefits.

8.3.3 Sediment-3: Granular Material Sediment Cap

8.3.3.1 Overall Protection of Human Health and the Environment

Sediment capping would provide overall protection of human health and the environment by eliminating the potential human health and ecological exposure pathways associated with impacted sediment. Clean cap material would prevent direct exposure of humans and ecological receptors to contaminated sediment. Reduction in direct exposure to COPCs and potential COPC releases to the water column are expected to reduce risks to fish and to humans and wildlife that consume fish.

8.3.3.2 Compliance with ARARs

There are no chemical-specific ARARs (i.e., RCRA, CWA, etc.) for sediments. However, there are TBCs (i.e., NYSDEC sediment screening values). Sediment capping would comply with TBCs. Sediment caps are routinely installed in compliance with ARARs and TBCs, which would include the substantive requirements of the dredge and fill permit program under Section 404 of the CWA. This alternative would also be in compliance with TSCA.

8.3.3.3 Long-Term Effectiveness and Permanence

Capping using a granular sediment and an armor layer (where required) is a proven technology for isolating contaminated sediments from the water column and biota if proper design, placement, and maintenance of the cap are performed to provide cap effectiveness, continued performance, and reliability. Capping would reduce the mobility of contaminants in the creek but would not affect toxicity or volume of contaminants. Because contamination remains in the sediment, capping alternatives may be inherently less protective of human health and the environment in the long term than removal alternatives. Even though the capping concept is designed to avoid failure, catastrophic natural events like major floods cannot be avoided. However, the placement of an armor layer in areas potentially susceptible to erosion and scouring either during baseflow conditions or flooding events minimizes potential failures of this capping technology. Additionally, damaged cap materials would be repaired and/or replaced as needed following major natural or made-made events.

Consistent with EPA design guidance for caps, the sediment cap would be designed to withstand erosional forces resulting from the 100-year return interval storm event. Controls, such as bans on dredging the capped area, would be implemented as necessary to help ensure the long-term integrity of the cap. As part of a site management plan, maintenance and monitoring program would be implemented to confirm that the sediment cap remains effective over time.

However, it important to note that Lower Ley Creek has been dredged in the past to alleviate flooding and may need to be dredged in the future. Therefore, a ban on dredging in the capped/backfill areas may not be feasible.

8.3.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Capping relies on isolation rather than treatment to achieve effectiveness. Capping would result in some reduction in the volume of the impacted sediment due to initial excavation before the installation of the cap. Natural processes that reduce toxicity such as biological degradation of organic compounds would continue to occur beneath the cap following construction and would be monitored as described in Section 7.

8.3.3.5 Short-Term Effectiveness

Sediment capping may cause short-term adverse impacts to the creek. These impacts include excavation of the benthic community and temporary loss of benthos and habitat for the ecological community during capping. Replacement of the benthic habitat would be implemented through addition of appropriate backfill material on top of the cap after cap placement. Natural benthic recolonization following a disturbance is rapid, and in many instances the process begins within days after perturbation.

Physical construction of the sediment cap could likely be completed in approximately one construction season. The effects of this alternative during the construction and implementation phase would potentially include:

- Temporary loss of creek habitat;
- Temporary impacts associated with sedimentation resulting from cap placement;
- Potential for on-site worker and transportation accidents associated with remedial construction; and
- Potential for on-site workers to receive adverse impacts through dermal contact with contaminated sediment.

All of the short-term impacts discussed above would be minimized or mitigated by exercising sound engineering practices, following appropriate health and safety protocols, wearing proper PPE, and adequate monitoring. The primary short-term negative ecological impact under this alternative would be the temporary elimination of benthic macro invertebrate communities.

8.3.3.6 Implementability

Appropriate sediment capping technologies are readily available and implementable, and construction procedures are well established. Sediment capping using granular material and armor stone has been demonstrated as an effective remedial technology for impacted sediments at numerous sites. The technology, equipment, subcontractors, personnel, and facilities required to successfully complete this alternative are available in the environmental market place. Short-term and long-term monitoring of this alternative can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken should the alternative prove to be ineffective or partially ineffective.

8.3.3.7 Cost

8.3.3.7.1 On-site Disposal

The costs of installing the sediment cap would be approximately $5.9 million. Total present worth is approximately $10.8 million for this alternative. A detailed cost breakdown is provided in Appendix C, Table C-2.

8.3.3.7.2 Off-site Disposal

The costs of installing the sediment cap would be approximately $10.6 million. Total present worth is approximately $17.6 million for this alternative. A detailed cost breakdown is provided in Appendix C, Table C-4.

8.3.3.8 State Acceptance

Not evaluated.

8.3.3.9 Community Acceptance

Not evaluated.

8.3.3.10 Conclusion

This alternative significantly reduces the risks to human health and the environment from contaminants at the site. This conclusion is based on a combination of factors that includes the area remediated, the volume of sediments removed, and the length of creek affected. This alternative appears to provide a good balance in achieving the RAOs and cleanup goals at costs comparable with Sediment Alternative 4. This alternative significantly reduces the risks to human health and the environment from sediment contamination at the site.

8.3.4 Sediment-4: Engineered Bentonite Sediment Cap

8.3.4.1 Overall Protection of Human Health and the Environment

Sediment capping would provide overall protection of human health and the environment by eliminating the potential human health and ecological exposure pathways associated with impacted sediment. Clean cap material would prevent direct exposure of humans and ecological receptors to contaminated sediment. Reduction in direct exposure to COPCs and potential COPC releases to the water column are expected to reduce risks to fish and to humans and wildlife that consume fish.

8.3.4.2 Compliance with ARARs

There are no chemical-specific ARARs (i.e., RCRA, CWA, etc.) for sediments. However, there are TBC values (i.e., NYSDEC sediment screening values). Sediment capping would comply with these TBCs. Sediment caps are routinely installed in compliance with ARARs and TBCs, which would include the substantive requirements of the dredge and fill permit program under Section 404 of the CWA. This alternative would also be in compliance with TSCA.

8.3.4.3 Long-Term Effectiveness and Permanence

Capping using an engineered bentonite is a proven technology for isolating contaminated sediments from the water column and biota if proper design, placement, and maintenance of the cap are performed to provide cap effectiveness, continued performance, and reliability. Capping would reduce the mobility of contaminants in the creek but would not affect toxicity or volume of contaminants. Because contamination remains in the sediment, capping alternatives may be inherently less protective of human health and the environment in the long term than removal alternatives. Even though the capping concept is designed to avoid failure, catastrophic natural events like major floods cannot be avoided.

Bentonite cap materials are more resistive to erosional forces in high velocity streams. The bentonite material can provide substrate for wetland vegetation and habitat for macroinvertebrate organisms, particularly when additional organic material is incorporated into the engineering design or as a surficial dressing. Bentonite cap materials are more effective in limiting the migration of contaminants in sediment compared to more permeable materials such as sand (EPA, 2007).

However, it is possible that an engineered bentonite cap could act to divert contaminant flux (fluid or vapor phase) to the periphery of a capped area, potentially biasing and concentrating the flux of contamination in discrete locations even beyond the original contaminant footprint.

Consistent with EPA design guidance for caps, the sediment cap would be designed to withstand erosional forces resulting from the 100-year return interval storm event. Controls, such as bans on dredging the capped area, would be implemented as necessary to help ensure the long-term integrity of the cap. As part of a site management plan, maintenance and monitoring program would be implemented to confirm that the sediment cap remains effective over time.

However, it important to note that Lower Ley Creek has been dredged in the past to alleviate flooding and may need to be dredged in the future. Therefore, a ban on dredging in the capped/backfill areas may not be feasible.

8.3.4.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Capping relies on isolation rather than treatment to achieve effectiveness. Capping would result in some reduction in the volume of the impacted sediment due to initial excavation before the installation of the cap. Natural processes that reduce toxicity such as biological degradation of organic compounds would continue to occur beneath the cap following construction and would be monitored as described in Section 7.

8.3.4.5 Short-Term Effectiveness

Sediment capping may cause short-term adverse impacts to the creek. These impacts include excavation of the benthic community and temporary loss of benthos and habitat for the ecological community during capping. Replacement of the benthic habitat would be implemented through addition of appropriate backfill material on top of the cap after cap placement. Natural benthic recolonization following a disturbance is rapid, and in many instances the process begins within days after perturbation.

Physical construction of the sediment cap could likely be completed in approximately one construction season. The effects of this alternative during the construction and implementation phase would potentially include:

- Temporary loss of creek habitat;
- Temporary impacts associated with sedimentation resulting from cap placement;
- Potential for on-site worker and transportation accidents associated with remedial construction; and
- Potential for on-site workers to receive adverse impacts through dermal contact with contaminated sediment.

All of the short-term impacts discussed above can be minimized or mitigated by exercising sound engineering practices, following appropriate health and safety protocols, wearing proper PPE, and adequate monitoring. The primary short-term negative ecological impact under this alternative would be the temporary elimination of benthic macro invertebrate communities.

8.3.4.6 Implementability

Installation of a bentonite cap can be performed using commonly available equipment and technologies, including conveyors, excavators, or cranes with clamshell buckets. As a result, implementation of this technology can be efficient and cost effective.

Sediment capping using engineered bentonite material has been demonstrated as an effective remedial technology for impacted sediments at numerous sites. Equipment and services for sediment capping are available commercially. The potentially large volume of material required for cap construction would require significant coordination of the cap placement, material handling and transportation activities. There appears to be property available for the land-support areas that would be required for capping of sediments. Short-term and long-term monitoring of this alternative can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken, should the alternative prove to be ineffective or partially ineffective.

8.3.4.7 Cost

8.3.4.7.1 On-site Disposal

The costs of installing the sediment cap would be $5.8 million. Total present worth is approximately $10.6 million for this alternative. A detailed cost breakdown is provided in Appendix C, Table C-2.

8.3.4.7.2 Off-site Disposal

The costs of installing the sediment cap would be $9 million. Total present worth is approximately $15.3 million for this alternative. A detailed cost breakdown is provided in Appendix C, Table C-4.

8.3.4.8 State Acceptance

Not evaluated.

8.3.4.9 Community Acceptance

Not evaluated.

8.3.4.10 Conclusion

This alternative significantly reduces the risks to human health and the environment from contaminants at the site. This conclusion is based on a combination of factors that includes the area remediated, the volume of sediments removed, and the length of creek affected. This alternative appears to provide a good balance in achieving the RAOs and cleanup goals at costs comparable with Sediment Alternative 3. This alternative significantly reduces the risks to human health and the environment from sediment contamination at the site.

8.3.5 Sediment-5: Monitored Natural Recovery

8.3.5.1 Overall Protection of Human Health and the Environment

MNR of the creek sediments would not eliminate the risks to human health and the environment. If completed in conjunction with controls it would protect humans by eliminating the potential human exposure, but would not eliminate the exposures to the environment. Environmental exposures would be expected to drop due to natural processes in the creek (i.e., sedimentation, biodegradation).

8.3.5.2 Compliance with ARARs

There are no chemical-specific ARARs for sediments. However, there are TBCs (i.e., NYSDEC sediment screening values). The MNR alternative would not meet these TBCs.

8.3.5.3 Long-Term Effectiveness and Permanence

This alternative would not likely provide long-term effectiveness and permanence because the potential human health and ecological exposure pathways associated with impacted sediment would remain at the site for an extended period of time.

Controls, such as bans on dredging and fishing, would be implemented as necessary until monitoring confirms the elimination of the contaminant risks.

8.3.5.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Natural processes that reduce toxicity, such as biological degradation of organic compounds along with sedimentation to reduce the exposure to the contaminants, would continue to occur in the creek and be monitored.

8.3.5.5 Short-Term Effectiveness

The MNR alternative does not include any physical construction measures in any areas of contamination and, therefore, would not present any potential adverse impacts to the community.

Monitoring activities would present temporary health and safety risks to workers that could easily be addressed with proper work procedures and equipment.

8.3.5.6 Implementability

Short-term and long-term monitoring of this alternative can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken should the alternative prove to be ineffective or partially ineffective.

8.3.5.7 Cost

The costs for this alternative are relatively low compared to other action alternatives and include no capital costs. Costs include for this alternative include sampling costs, reporting costs, project management costs, and costs for 5-year reviews. The total present worth of this alternative is approximately $2 million. A cost breakdown is provided in Appendix C.

8.3.5.8 State Acceptance

Not evaluated.

8.3.5.9 Community Acceptance

Not evaluated.

8.3.5.10 Conclusion

The MNR alternative would not actively reduce the toxicity, mobility, or volume of the contamination through treatment. The cancer risks and non-cancer human health hazards and risks to ecological receptors posed by fish consumption would continue to remain above acceptable levels and the surface water quality would continue to be degraded.

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9.0 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

This section presents a comparative analysis of the four soil remedial alternatives and the five sediment remedial alternatives developed for the Lower Ley Creek Site. This analysis evaluates the alternatives against the seven evaluation criteria in comparison to each other. State acceptance will be addressed by EPA in the Proposed Plan and ROD, respectively. Community Acceptance will be addressed in the ROD.

9.1 SOIL REMEDIAL ALTERNATIVES

The four soil alternatives are:

- Soil Alternative 1 - No Action;
- Soil Alternative 2 - Excavation of Soil to Meet Cleanup Goals;
- Soil Alternative 3 - Excavation of Southern Swale Soils to Meet Cleanup Goals and Soil Cap for Northwest Soils; and
- Soil Alternative 4 - Soil Cap Over All Contaminated Soils.

A comparative evaluation of the four soil alternatives is presented in Table 9.1 and discussed below.

9.1.1 Overall Protection of Human Health and Environment

Alternative 1 is not protective of human health and the environment.

Alternative 2 is the most protective because it removes the most contamination, as some will be left in place in the vicinity of the pipelines. Alternative 3 is slightly less protective of human health and the environment because it removes less contaminants from the soils and relies more on isolation (capping) to eliminate exposure pathways.

Alternative 4 is slightly less protective than Alternatives 2 and 3 because it eliminates the exposure pathways of soil contaminants via isolation (capping) rather than removing them from the environment.

9.1.2 Compliance with ARARs

Alternative 1 would not meet chemical-specific ARARs (i.e., RCRA, CWA, etc.) or be in compliance with TSCA.

Alternatives 2, 3, and 4 would meet the chemical-specific, location-specific, and action-specific ARARs (i.e., RCRA, CWA, etc.) and be in compliance with TSCA.

9.1.3 Long-Term Effectiveness and Permanence

Alternative 1 would not provide long-term effectiveness or permanence. Under the remaining alternatives, long-term effectiveness and permanence would depend on the effectiveness of source control (excavation and capping) measures in maintaining reliable protection for human health and the environment once RAOs are met. It is expected that Alternatives 2, 3, and 4 would provide long-term effectiveness and permanence.

With the exception of Alternative 1, long-term monitoring and the implementation of a site management plan would ensure the adequacy and reliability of these actions to control untreated wastes that remain following completion of the remedial action. All Soil Alternatives, with the exception of the No Action Alternative, would require some degree of long-term monitoring. However, Alternative 2 would provide the highest degree of long-term effectiveness and permanence due to the significant reduction in soil contamination via excavation. Alternatives 3 and 4 would require more extensive long-term monitoring activities than Alternative 2 due to monitoring requirements associated with cap maintenance. Alternative 4 would rely only on capping and would therefore require the most extensive long-term monitoring.

9.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Over a long period of time, natural processes would slightly reduce the toxicity, mobility, and volume of contaminants in the soil under Alternative 1. However, they would not be reduced significantly over time and Alternative 1 would not monitor or control these processes.

In comparison with the other alternatives, Alternative 2 would reduce the toxicity, mobility, and volume of impacted soils the greatest through extensive soil excavation. Alternative 3 would also reduce a large volume of the contaminated soils in the environment by excavation in the Southern Swale Soil Area and reduce the mobility of contaminants in the soil by capping in the Northwest Soil Area.

Alternative 4 reduces the mobility of contaminants through soil capping, but has little effect on the toxicity and volume of contaminants.

9.1.5 Short-Term Effectiveness

The alternative with the least amount of physical construction and material movement (Alternative 1) would have the lowest amount of short-term impacts on the environment.

All the active soil alternatives (2, 3, and 4) would result in short-term habitat destruction and impact to local property owners by either excavation or capping activities. Alternatives 2 and 3 would have the most short-term impacts because excavation activities would elevate short-term risks for construction workers, impact local property owners, and result in the temporary loss of habitats. The capping of soils associated with Alternative 4 would have slightly less short-term impacts than the excavation of contaminated soil proposed in Alternatives 2 and 3.

For all alternatives, appropriate measures would be taken to minimize any adverse impacts from soil excavation activities, including measures to prevent transport of fugitive dust and exposure of workers and downgradient receptors to contamination. All of the short-term impacts can be minimized or mitigated by exercising sound engineering practices, following appropriate health and safety protocols, wearing proper PPE, and adequate monitoring.

9.1.6 Implementability

No technical or administrative issues have been identified that would limit the feasibility of implementing Alternative 1.

Appropriate soil excavation technologies are readily available and implementable for Alternatives 2 and 3. The size and duration of the removal activities in Alternative 2 would present more implementation challenges than the other three alternatives.

Appropriate soil capping technologies are readily available and implementable for Alternatives 2, 3, and 4.

Short-term and long-term monitoring as part of a site management plan for Alternatives 2, 3, and 4 can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken, should the alternatives prove to be ineffective or partially ineffective.

9.1.7 Cost

Capital costs for soil removal, off-site transportation, and disposal or treatment are higher compared to costs involving installation of a soil cap over equivalent target areas. Operation and maintenance costs for a soil removal alternative will be lower than for implementation of a soil capping alternative for an equivalent area, as removal-only alternatives do not require long-term maintenance.

Costs for soil capping alternatives vary primarily with the total area covered. Operation and maintenance costs for a soil cap alternative will be higher than for a soil removal alternative involving the same areas because of soil cap maintenance costs, institutional controls, and the implementation of a site management plan.

9.1.7.1 On-site Disposal

The cost estimates for each soil remedial alternative are detailed in Appendix C, Table C-1. The alternatives with the least amount of construction and off-site disposal activity are the least costly to implement. Alternative 1 is the least costly. Alternative 2 includes the largest amount of excavation and disposal of impacted soils and therefore carries the highest cost. Alternative 3, which proposes a mix of excavation and capping activities, is the next most costly alternative. Finally, Alternative 4 (Capping of Soils) is higher in cost than the No Action alternative but is less costly than the excavation alternatives because of the reduced excavation costs.

9.1.7.2 Off-site Disposal

The cost estimates for each soil remedial alternative are detailed in Appendix C, Table C-3. The alternatives with the least amount of construction and off-site disposal activity are the least costly to implement. Alternative 1 is the least costly. Alternative 2 includes the largest amount of excavation and disposal of impacted soils and therefore carries the highest cost. Alternative 3, which proposes a mix of excavation and capping activities, is the next costliest alternative. Finally, Alternative 4 (Capping of Soils) is higher in cost than the No Action alternative but is significantly less costly than the excavation alternatives because of the reduced waste disposal costs.

9.2 SEDIMENT REMEDIAL ALTERNATIVES

The four sediment alternatives are:

- Sediment Alternative 1 – No Action;
- Sediment Alternative 2 – Removal of All Sediments to Cleanup Goals;
- Sediment Alternative 3 – Granular Material Sediment Cap;
- Sediment Alternative 4 – Engineered Bentonite Sediment Cap; and
- Sediment Alternative 5 – Monitored Natural Recovery.

A comparative evaluation of the five sediment alternatives is presented in Table 9.2 and discussed below.

9.2.1 Overall Protection of Human Health and Environment

Alternative 1 and Alternative 5 are not protective of human health and the environment.

Alternative 2 is the most protective because it provides complete removal of the contaminants from the environment where possible.

Alternatives 3 and 4 are slightly less protective than Alternative 2 because they eliminate the exposure pathways of sediment contaminants rather than removing contaminants from the environment.

9.2.2 Compliance with ARARs

There are no chemical-specific ARARs for sediments. However, there are TBC values (i.e., NYSDEC sediment screening values). Alternative 1 and Alternative 5 would not meet TBC sediment screening values or be in compliance with TSCA.

Sediment removal in Alternative 2 would comply with TBCs and be in compliance with TSCA. The excavation and backfilling work may result in short-term localized exceedences of surface water criteria due to suspension of impacted sediment during excavation. However, the water quality impacts from excavation would meet the substantive water quality requirements imposed by NYS on entities seeking a dredged material discharge permit under Section 404 of the CWA.

Sediment caps in Alternatives 3 and 4 are routinely installed in compliance with ARARs and TBCs, which would include the substantive requirements of the dredge and fill permit program under Section 404 of the CWA.

9.2.3 Long-Term Effectiveness and Permanence

Alternative 1 and Alternative 5 would not provide long-term effectiveness or permanence. Alternative 2 provides the most long-term effectiveness and permanence because it permanently removes all the contaminants in sediments.

Consistent with EPA design guidance for caps, the sediment caps and backfill areas associated with Alternative 3 and 4 would be designed to withstand erosional forces resulting from the 100-year return interval storm event. Institutional controls, such as bans on dredging the capped or backfilled areas, would be implemented as necessary to help ensure the long-term integrity of these barriers.

With the exception of Alternative 1, long-term monitoring and the implementation of a site management plan would ensure the adequacy and reliability of these actions to control untreated wastes that remain. Alternative 2 would require the least amount of long-term monitoring because all of the contaminated sediments would be removed. Alternatives 3 and 4 would require the most amount of long-term monitoring because most of the contaminated sediments would be left in place. A site management plan would needs to be implemented under these alternatives to ensure the effectiveness and permanence of the sediment caps.

9.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Over a long period of time, natural processes would slightly reduce the toxicity, mobility, and volume of contaminants in the soil under Alternative 1 and Alternative 5. However, they would not be reduced significantly over time and Alternative 1 would not monitor or control these processes.

In comparison with the other alternatives, Alternative 2 would reduce the toxicity, mobility, and volume of impacted soils the greatest through extensive sediment excavation.

Alternatives 3 and 4 reduce the mobility of contaminants through sediment capping, but have little effect on the toxicity and volume of contaminants.

9.2.5 Short-Term Effectiveness

The alternative with the least amount of physical construction and material movement (Alternative 1) would have the lowest amount of short-term impacts on the environment. Alternative 5 would have slightly more short-term impacts on the environment than Alternative 1, but monitoring activities have very low impacts.

Alternatives 2-4 would result in short-term habitat destruction and impact to local property owners by either excavation or capping activities. Alternative 2 would have the most short-term impacts because excavation activities would elevate short term risks for construction workers, impact local property owners, and lead to the temporary loss of habitats. The capping of sediments associated with Alternatives 3 and 4 would have slightly less short-term impacts than the excavation of contaminated sediments proposed in Alternative 2.

For all alternatives, the short-term impacts would be minimized or mitigated by exercising sound engineering practices, following appropriate health and safety protocols, wearing proper PPE, and adequate monitoring.

9.2.6 Implementability

No technical or administrative issues have been identified that would limit the feasibility of implementing Alternative 1 or Alternative 5.

Appropriate sediment excavation technologies are readily available and implementable for Alternative 2. The size and duration of the removal activities in Alternative 2 would present more implementation challenges than the other alternatives.

Appropriate sediment capping technologies are readily available and implementable for Alternatives 3 and 4.

Short-term and long-term monitoring as part of a site management plan for Alternatives 3 and 4 can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken, should the alternatives prove to be ineffective or partially ineffective.

9.2.7 Cost

For the granular/armor sediment capping alternative (Alternative 3), the requirements of 2 ft of habitat material, armoring requirements, isolation thickness requirements, along with the need to excavate additional sediments to maintain the bathymetry of the creek, causes this alternative to be more expensive than the excavation alternative. The requirement of 2 ft of habitat material above the engineered bentonite capping alternative (Alternative 4), along with the need to excavate additional sediments to maintain the bathymetry of the creek also causes this alternative to be more expensive than the excavation alternative (Alternative 2).

O&M costs for a sediment removal alternative will be lower than for implementation of a capping alternative for an equivalent area, as removal-only alternatives do not require long-term maintenance. O&M costs for a capping alternative will be higher than for a sediment removal alternative involving the same areas because of site management costs and, to a lesser extent, potential cap maintenance required in the long term.

9.2.7.1 <u>On-site Disposal</u>

The cost estimates for each sediment remedial alternative are detailed in Appendix C, Table C-2. Alternative 1 is the least costly alternative, followed by Alternative 5. Although Alternative 2 includes the largest amount of excavation, the lack of required capping materials for backfill leads to the overall cost of this alternative being less than the capping alternatives. Alternatives 3 and 4 (Capping of Sediments) are higher in costs than the other alternatives. Because Capping Alternative 4 requires less sediment removal than Capping Alternative 3, it has a slightly lower overall cost.

9.2.7.2 Off-site Disposal

The cost estimates for each sediment remedial alternative are detailed in Appendix C, Table C-4. Alternative 1 is the least costly alternative, followed by Alternative 5. Although Alternative 2 includes the largest amount of excavation, the lack of required capping materials for backfill leads to the overall cost of this alternative being less than the Granular Material Cap Alternative (Alternative 3) but slightly higher than the Engineered Bentonite Cap Alternative (Alternative 4). Because Capping Alternative 4 requires less sediment removal than Capping Alternative 3, it has a lower overall cost.

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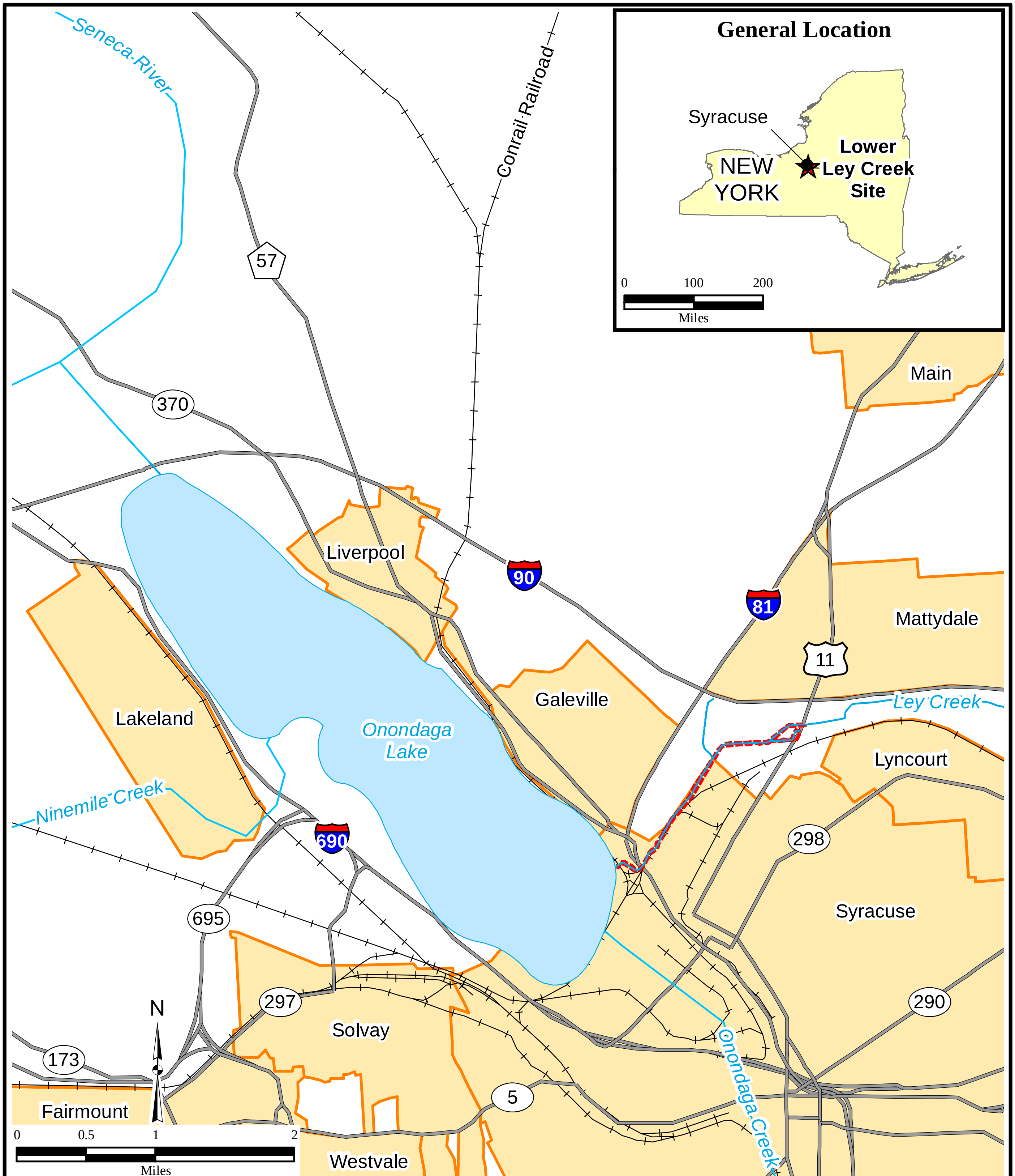
FIGURES



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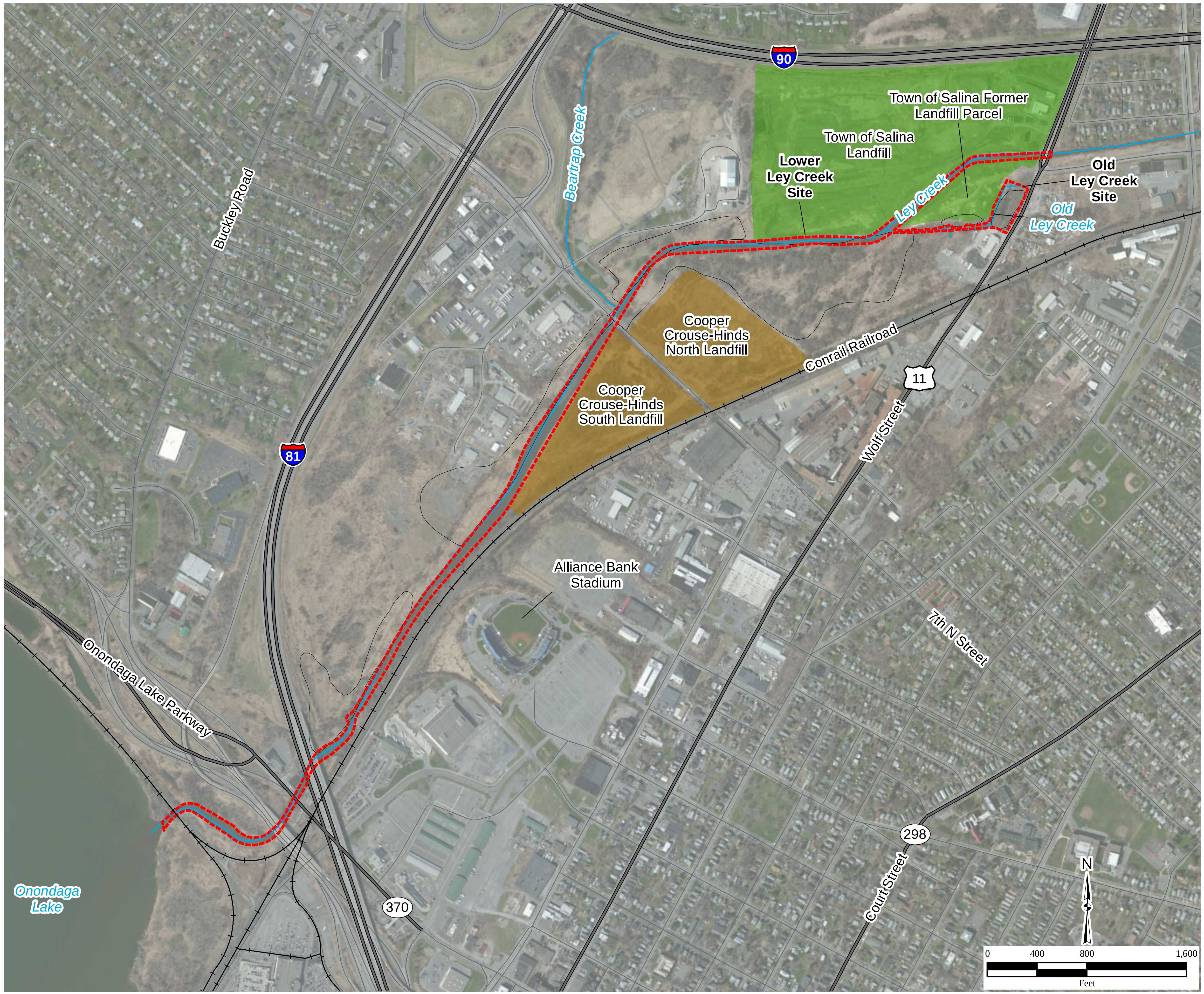
Source: HGL, ESRI

Legend
- Highway
- Railroad
- Surface Water Course
- City Limit
- Lower Ley Creek Site

Figure 2.1
Site Location

Figure 2.2
Site Layout



Legend

- Surface Water Course
- Road
- Highway
- Railroad
- Lower Ley Creek and Old Ley Creek Site Boundary
- Soil Site Boundary
- Cooper Crouse-Hinds Landfill
- Town of Salina Landfill and Former Landfill Parcel

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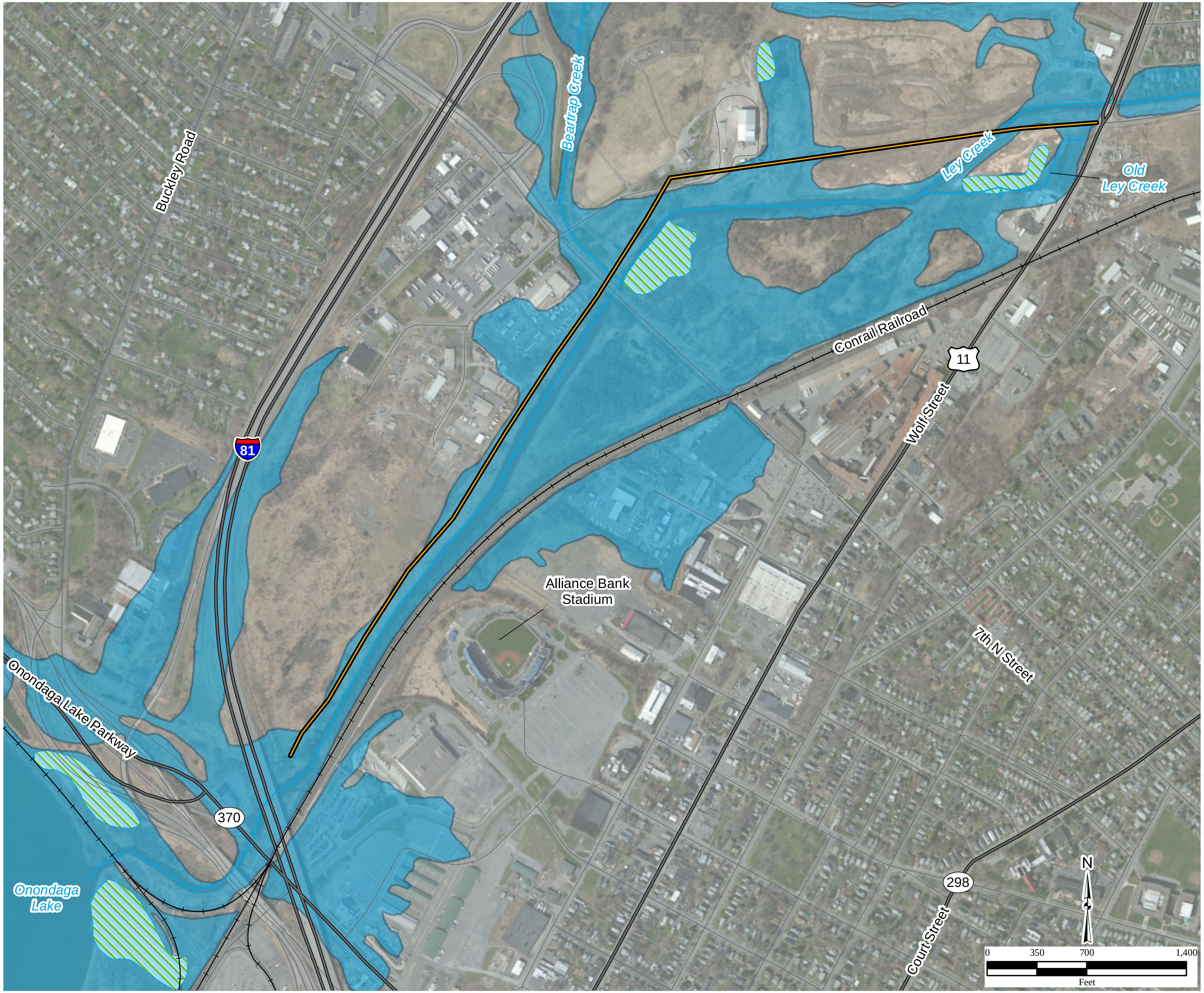
HGL HydroGeoLogic, Inc

Figure 2.3
Location of Pipelines, Floodplain, and Wetlands



Legend

- Natural Gas and Oil Pipelines within the Site Soil Boundary
- Surface Water Course
- Road
- Highway
- Railroad
- Wetlands
- Floodplain (100 year)

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Source: HGL, AE Engineering, ESRI,
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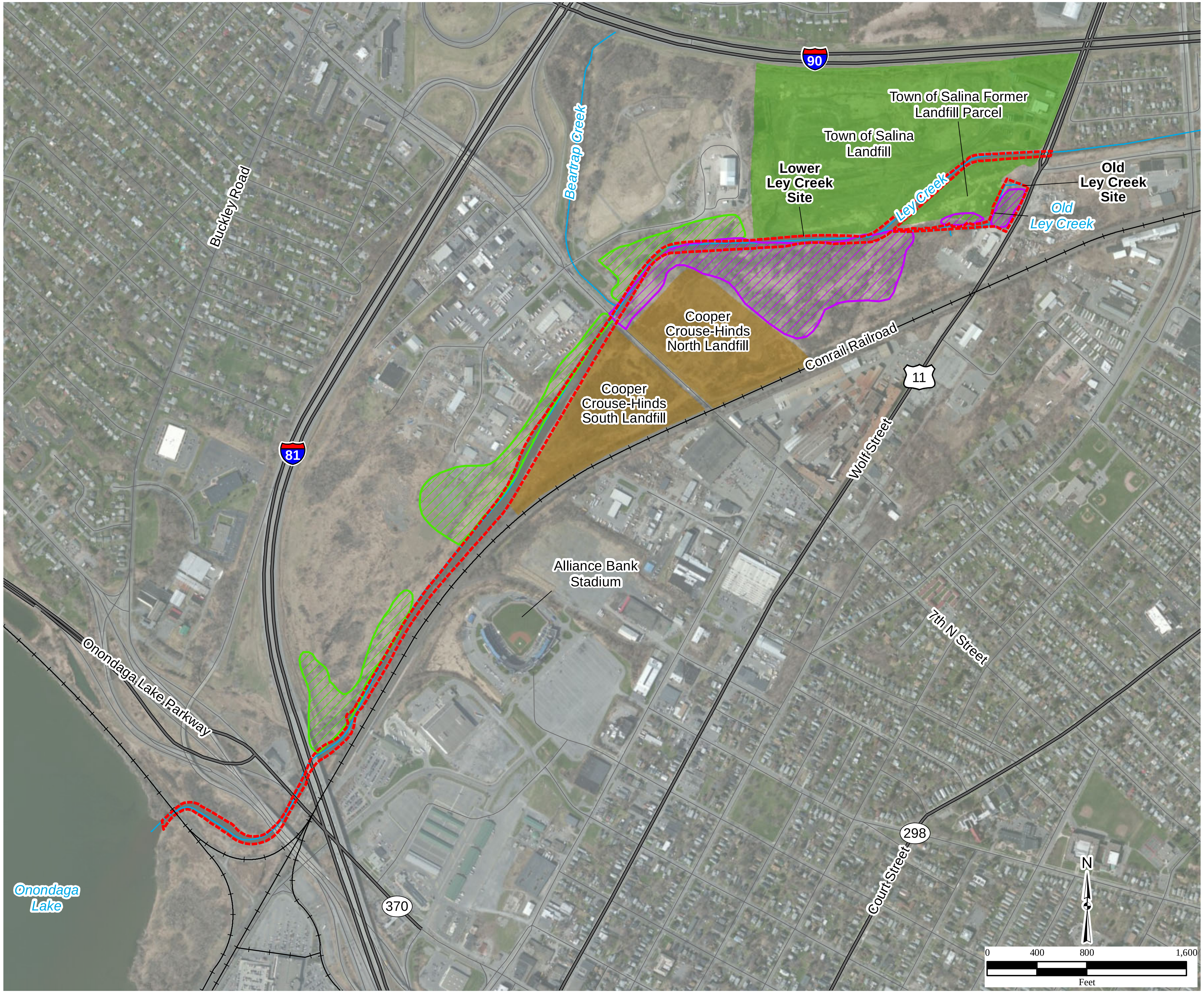
HGL HydroGeoLogic, Inc

HGL—FS Report
Lower Ley Creek Subsite of Onondaga Lake, Syracuse, NY

Figure 2.4
Soil Areas of Lower Ley Creek



Legend

- Surface Water Course
- Road
- Highway
- Railroad
- Lower Ley Creek and Old Ley Creek Site Boundary
- Southern Swale Soils
- Northwest Soils
- Cooper Crouse-Hinds Landfill
- Town of Salina Landfill and Former Landfill Parcel

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Source: HGL, AE Engineering, ESRI,
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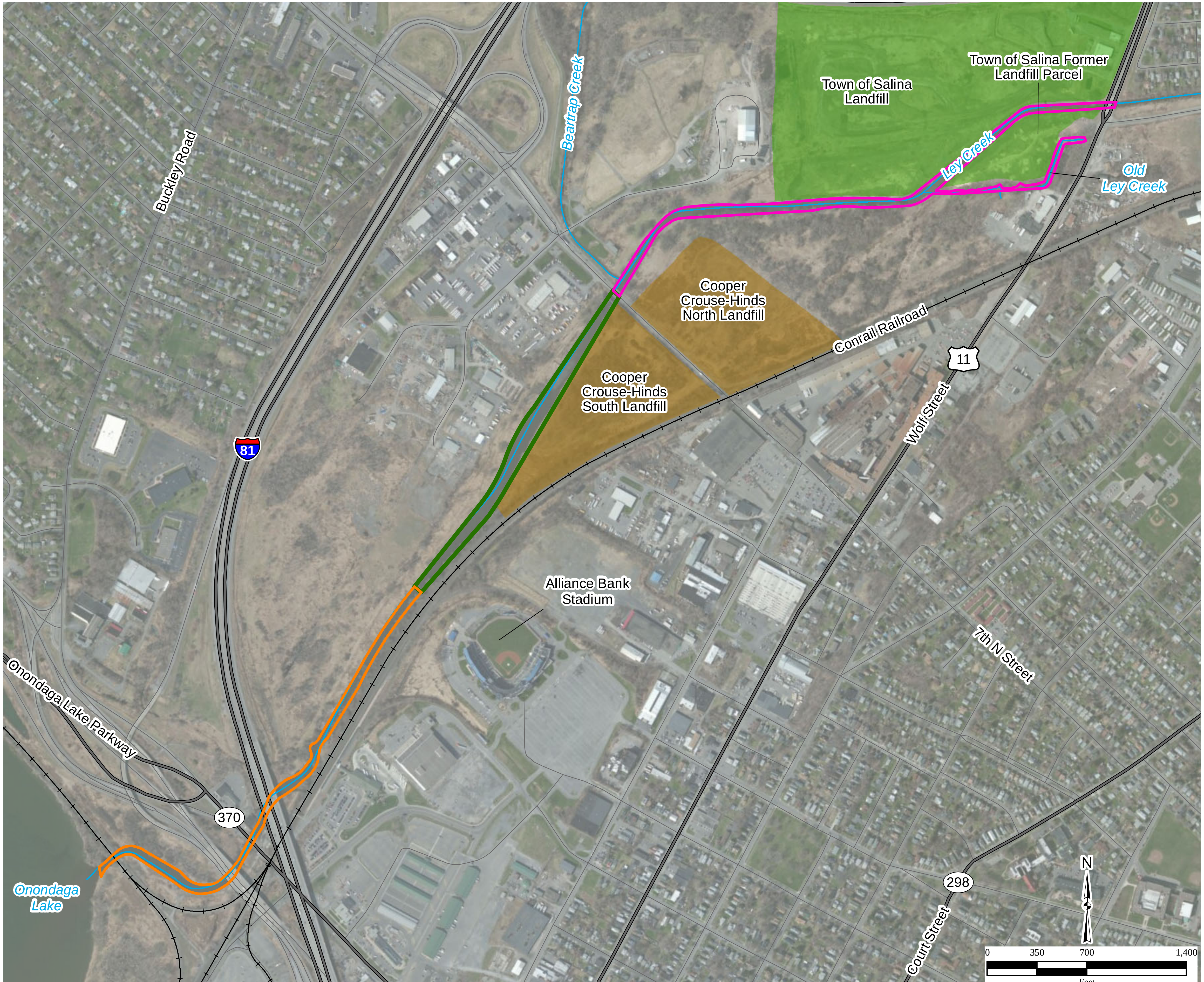
HGL HydroGeoLogic, Inc

Figure 2.5
Upstream, Middle, and Downstream Sections of Lower Ley Creek



Legend

- Surface Water Course
- Road
- Highway
- Railroad
- Cooper Crouse-Hinds Landfill
- Town of Salina Landfill and Former Landfill Parcel

Sections of Lower Ley Creek:

- Upstream
- Middle
- Downstream

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Source: HGL, AE Engineering, ESRI,
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HGL—FS Report
Lower Ley Creek Subsite of Onondaga Lake, Syracuse, NY

Figure 2.6
Cross Section Locations

Legend

- Surface Water Course
- Road
- Highway
- Railroad
- Cross Section

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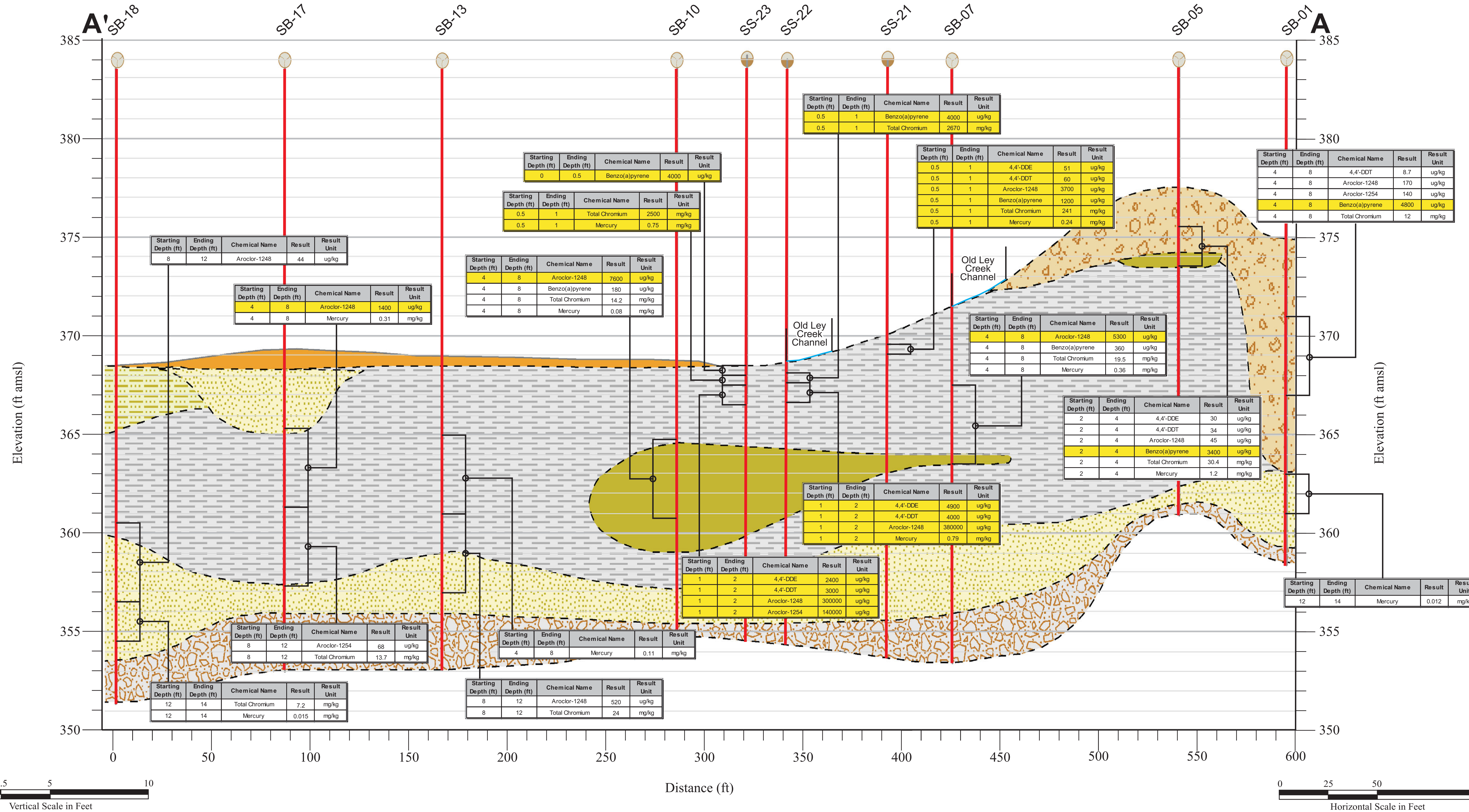

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
8	12	Aroclor-1248	44	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
12	14	Total Chromium	7.2	mg/kg
12	14	Mercury	0.015	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
4	8	Aroclor-1248	1400	ug/kg
4	8	Mercury	0.31	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
8	12	Aroclor-1254	68	ug/kg
8	12	Total Chromium	13.7	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
4	8	Aroclor-1248	7600	ug/kg
4	8	Benzo(a)pyrene	180	ug/kg
4	8	Total Chromium	14.2	mg/kg
4	8	Mercury	0.08	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
4	8	Mercury	0.11	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
8	12	Aroclor-1248	520	ug/kg
8	12	Total Chromium	24	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Benzo(a)pyrene	4000	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	Total Chromium	2500	mg/kg
0.5	1	Mercury	0.75	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1	2	4,4'-DDE	2400	ug/kg
1	2	4,4'-DDT	3000	ug/kg
1	2	Aroclor-1248	300000	ug/kg
1	2	Aroclor-1254	140000	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	Benzo(a)pyrene	4000	ug/kg
0.5	1	Total Chromium	2670	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1	2	4,4'-DDE	4900	ug/kg
1	2	4,4'-DDT	4000	ug/kg
1	2	Aroclor-1248	380000	ug/kg
1	2	Mercury	0.79	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	4,4'-DDE	51	ug/kg
0.5	1	4,4'-DDT	60	ug/kg
0.5	1	Aroclor-1248	3700	ug/kg
0.5	1	Benzo(a)pyrene	1200	ug/kg
0.5	1	Total Chromium	241	mg/kg
0.5	1	Mercury	0.24	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
4	8	Aroclor-1248	5300	ug/kg
4	8	Benzo(a)pyrene	360	ug/kg
4	8	Total Chromium	19.5	mg/kg
4	8	Mercury	0.36	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
2	4	4,4'-DDE	30	ug/kg
2	4	4,4'-DDT	34	ug/kg
2	4	Aroclor-1248	45	ug/kg
2	4	Benzo(a)pyrene	3400	ug/kg
2	4	Total Chromium	30.4	mg/kg
2	4	Mercury	1.2	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
4	8	4,4'-DDT	8.7	ug/kg
4	8	Aroclor-1248	170	ug/kg
4	8	Aroclor-1254	140	ug/kg
4	8	Benzo(a)pyrene	4800	ug/kg
4	8	Total Chromium	12	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
12	14	Mercury	0.012	mg/kg

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Source: HGL, EA Engineering*

HGL HydroGeoLogic, Inc

Legend

Boring

SB-17 Sample Location Identification

Lithology Boundary

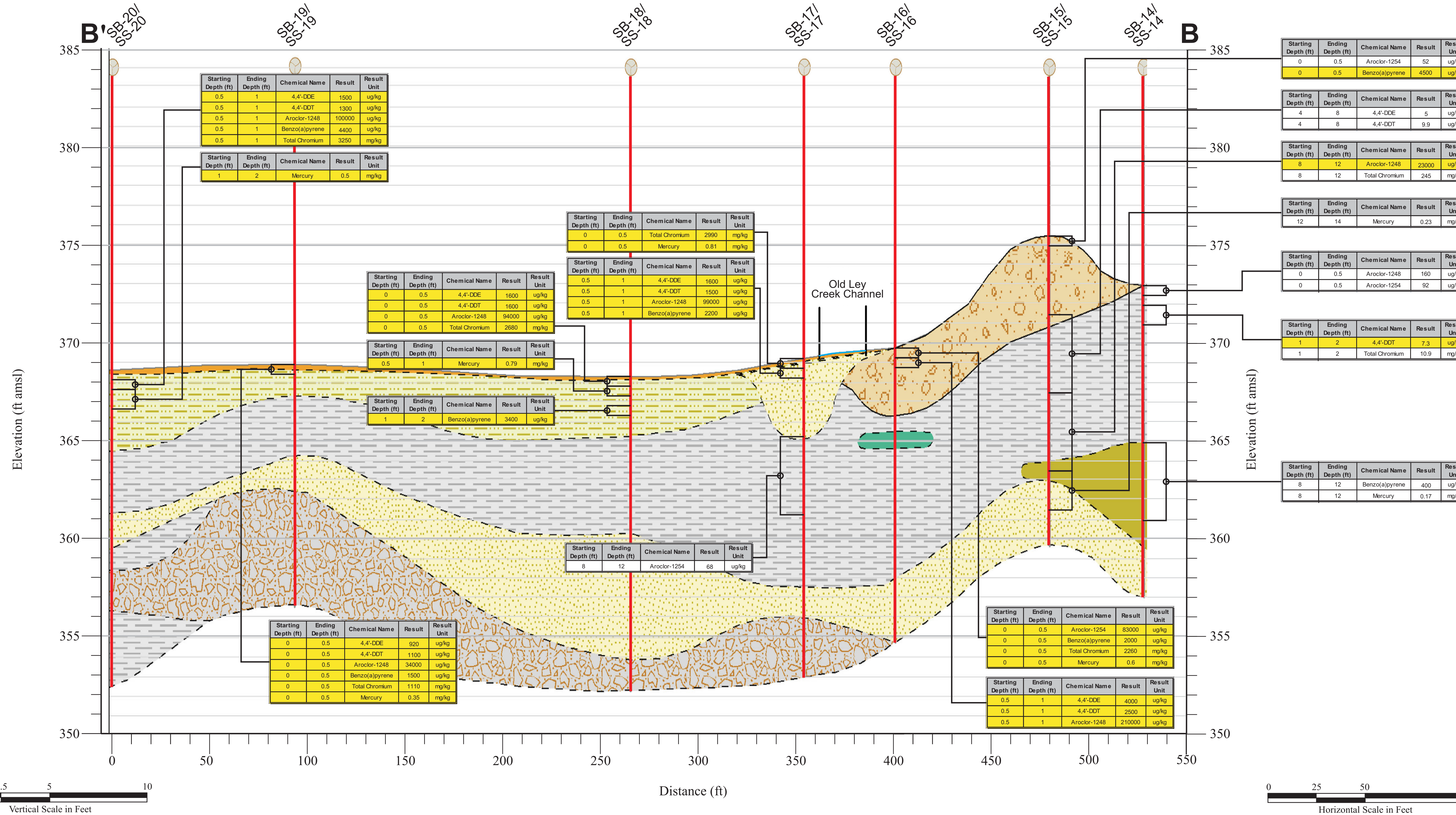
Stratigraphy Type:

- Top Soil
- Fill Material
- Peat
- Silt and Organics
- Silt and Clay
- Silt and Sand
- Till

Notes:
Included data tables represent maximum concentrations of major risk drivers per boring location.
Highlighted data indicate concentrations above cleanup goals.

µg/kg=micrograms per kilogram
mg/kg=milligrams per kilogram
amsl=above mean sea level
ft=feet

**Figure 2.7
Old Ley Creek
Northeast-Southwest
Cross Section A-A'**



Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	4,4'-DDE	1500	ug/kg
0.5	1	4,4'-DDT	1300	ug/kg
0.5	1	Aroclor-1248	100000	ug/kg
0.5	1	Benzo(a)pyrene	4400	ug/kg
0.5	1	Total Chromium	3250	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1	2	Mercury	0.5	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	4,4'-DDE	1600	ug/kg
0	0.5	4,4'-DDT	1600	ug/kg
0	0.5	Aroclor-1248	94000	ug/kg
0	0.5	Total Chromium	2680	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	Mercury	0.79	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1	2	Benzo(a)pyrene	3400	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	4,4'-DDE	920	ug/kg
0	0.5	4,4'-DDT	1100	ug/kg
0	0.5	Aroclor-1248	34000	ug/kg
0	0.5	Benzo(a)pyrene	1500	ug/kg
0	0.5	Total Chromium	1110	mg/kg
0	0.5	Mercury	0.35	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Total Chromium	2990	mg/kg
0	0.5	Mercury	0.81	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	4,4'-DDE	1600	ug/kg
0.5	1	4,4'-DDT	1500	ug/kg
0.5	1	Aroclor-1248	99000	ug/kg
0.5	1	Benzo(a)pyrene	2200	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
8	12	Aroclor-1254	68	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Aroclor-1254	83000	ug/kg
0	0.5	Benzo(a)pyrene	2000	ug/kg
0	0.5	Total Chromium	2260	mg/kg
0	0.5	Mercury	0.6	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	4,4'-DDE	4000	ug/kg
0.5	1	4,4'-DDT	2500	ug/kg
0.5	1	Aroclor-1248	210000	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Aroclor-1254	52	ug/kg
0	0.5	Benzo(a)pyrene	4500	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
4	8	4,4'-DDE	5	ug/kg
4	8	4,4'-DDT	9.9	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
8	12	Aroclor-1248	23000	ug/kg
8	12	Total Chromium	245	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
12	14	Mercury	0.23	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Aroclor-1248	160	ug/kg
0	0.5	Aroclor-1254	92	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1	2	4,4'-DDT	7.3	ug/kg
1	2	Total Chromium	10.9	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
8	12	Benzo(a)pyrene	400	ug/kg
8	12	Mercury	0.17	mg/kg

\\GST-SRV-01\hglgis\Ley_Creek_MSIW\FS\
Cross_section_B-B'.cdr
12/19/2013 CNL
Source: HGL, EA Engineering

HGL HydroGeoLogic, Inc

Legend

Boring

SB-20/SS-20 Sample Location Identification

Lithology Boundary

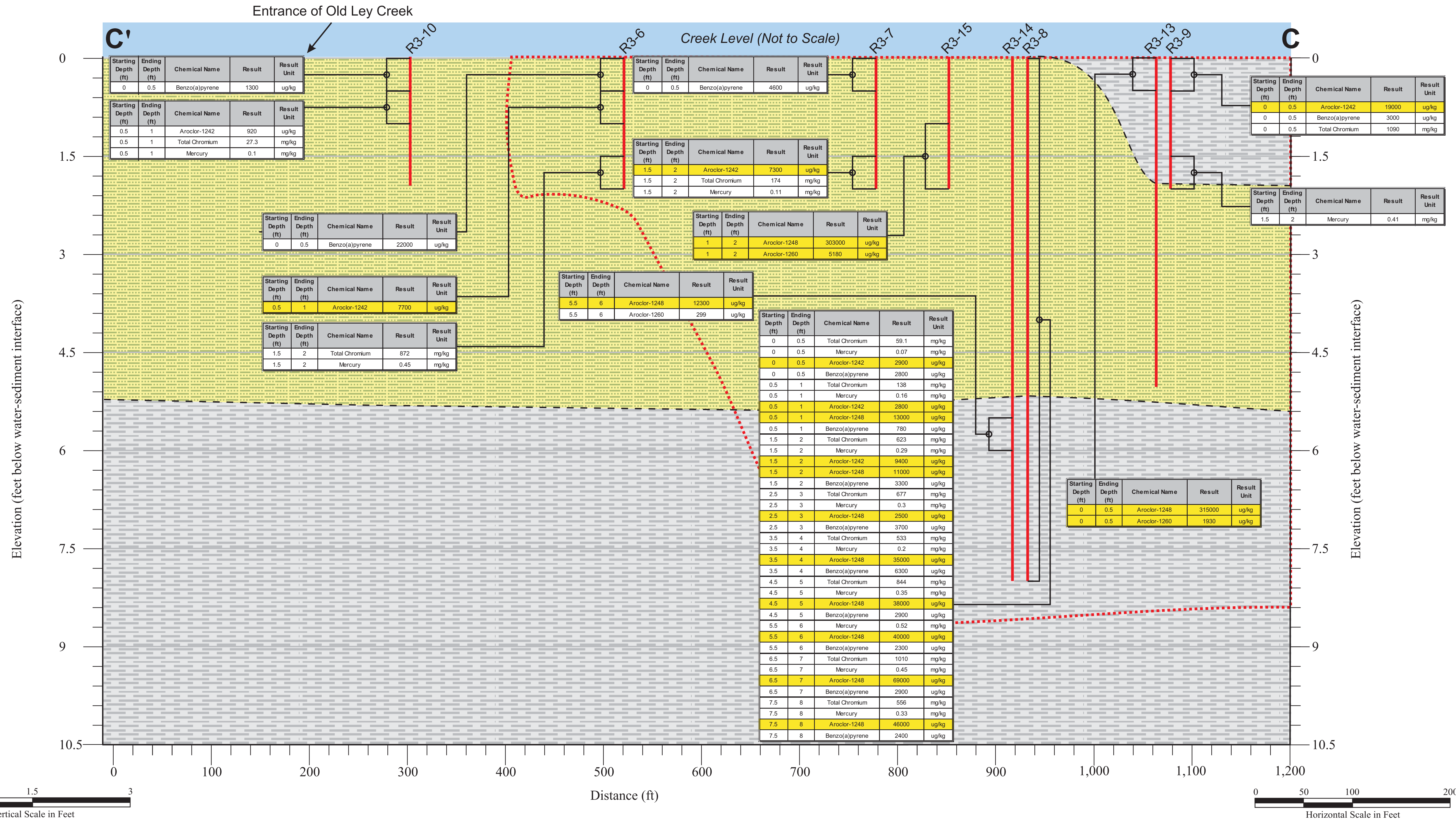
Stratigraphy Type:

- Top Soil
- Fill Material
- Peat
- Silt and Organics
- Silt and Clay
- Silt and Sand
- Till
- Stream Deposits

Notes:
Included data tables represent maximum concentrations of major risk drivers per boring location.
Highlighted data indicate concentrations above cleanup goals.

µg/kg=micrograms per kilogram
mg/kg=milligrams per kilogram
amsl=above mean sea level
ft=feet

Figure 2.8
Old Ley Creek
West-East
Cross Section B-B'



Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Benzo(a)pyrene	1300	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	Aroclor-1242	920	ug/kg
0.5	1	Total Chromium	27.3	mg/kg
0.5	1	Mercury	0.1	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Benzo(a)pyrene	22000	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	Aroclor-1242	7700	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1.5	2	Total Chromium	872	mg/kg
1.5	2	Mercury	0.45	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Benzo(a)pyrene	4600	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1.5	2	Aroclor-1242	7300	ug/kg
1.5	2	Total Chromium	174	mg/kg
1.5	2	Mercury	0.11	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1	2	Aroclor-1248	303000	ug/kg
1	2	Aroclor-1260	5180	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
5.5	6	Aroclor-1248	12300	ug/kg
5.5	6	Aroclor-1260	299	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Total Chromium	59.1	mg/kg
0	0.5	Mercury	0.07	mg/kg
0	0.5	Aroclor-1242	2900	ug/kg
0	0.5	Benzo(a)pyrene	2800	ug/kg
0.5	1	Total Chromium	138	mg/kg
0.5	1	Mercury	0.16	mg/kg
0.5	1	Aroclor-1242	2800	ug/kg
0.5	1	Aroclor-1248	13000	ug/kg
0.5	1	Benzo(a)pyrene	780	ug/kg
1.5	2	Total Chromium	623	mg/kg
1.5	2	Mercury	0.29	mg/kg
1.5	2	Aroclor-1242	9400	ug/kg
1.5	2	Aroclor-1248	11000	ug/kg
1.5	2	Benzo(a)pyrene	3300	ug/kg
2.5	3	Total Chromium	677	mg/kg
2.5	3	Mercury	0.3	mg/kg
2.5	3	Aroclor-1248	2500	ug/kg
2.5	3	Benzo(a)pyrene	3700	ug/kg
3.5	4	Total Chromium	533	mg/kg
3.5	4	Mercury	0.2	mg/kg
3.5	4	Aroclor-1248	35000	ug/kg
3.5	4	Benzo(a)pyrene	6300	ug/kg
4.5	5	Total Chromium	844	mg/kg
4.5	5	Mercury	0.35	mg/kg
4.5	5	Aroclor-1248	38000	ug/kg
4.5	5	Benzo(a)pyrene	2900	ug/kg
5.5	6	Mercury	0.52	mg/kg
5.5	6	Aroclor-1248	40000	ug/kg
5.5	6	Benzo(a)pyrene	2300	ug/kg
6.5	7	Total Chromium	1010	mg/kg
6.5	7	Mercury	0.45	mg/kg
6.5	7	Aroclor-1248	69000	ug/kg
6.5	7	Benzo(a)pyrene	2900	ug/kg
7.5	8	Total Chromium	556	mg/kg
7.5	8	Mercury	0.33	mg/kg
7.5	8	Aroclor-1248	46000	ug/kg
7.5	8	Benzo(a)pyrene	2400	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Aroclor-1248	315000	ug/kg
0	0.5	Aroclor-1260	1930	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Aroclor-1242	19000	ug/kg
0	0.5	Benzo(a)pyrene	3000	ug/kg
0	0.5	Total Chromium	1090	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1.5	2	Mercury	0.41	mg/kg

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Cross_section_C-C'.cdr
1/13/2014 CNL
Source: HGL

HGL
HydroGeoLogic, Inc

Legend

Boring

R3-9 Sample Location Identification

Lithology Boundary

Estimated Extent of Sediment above Cleanup Goals

Stratigraphy Type:

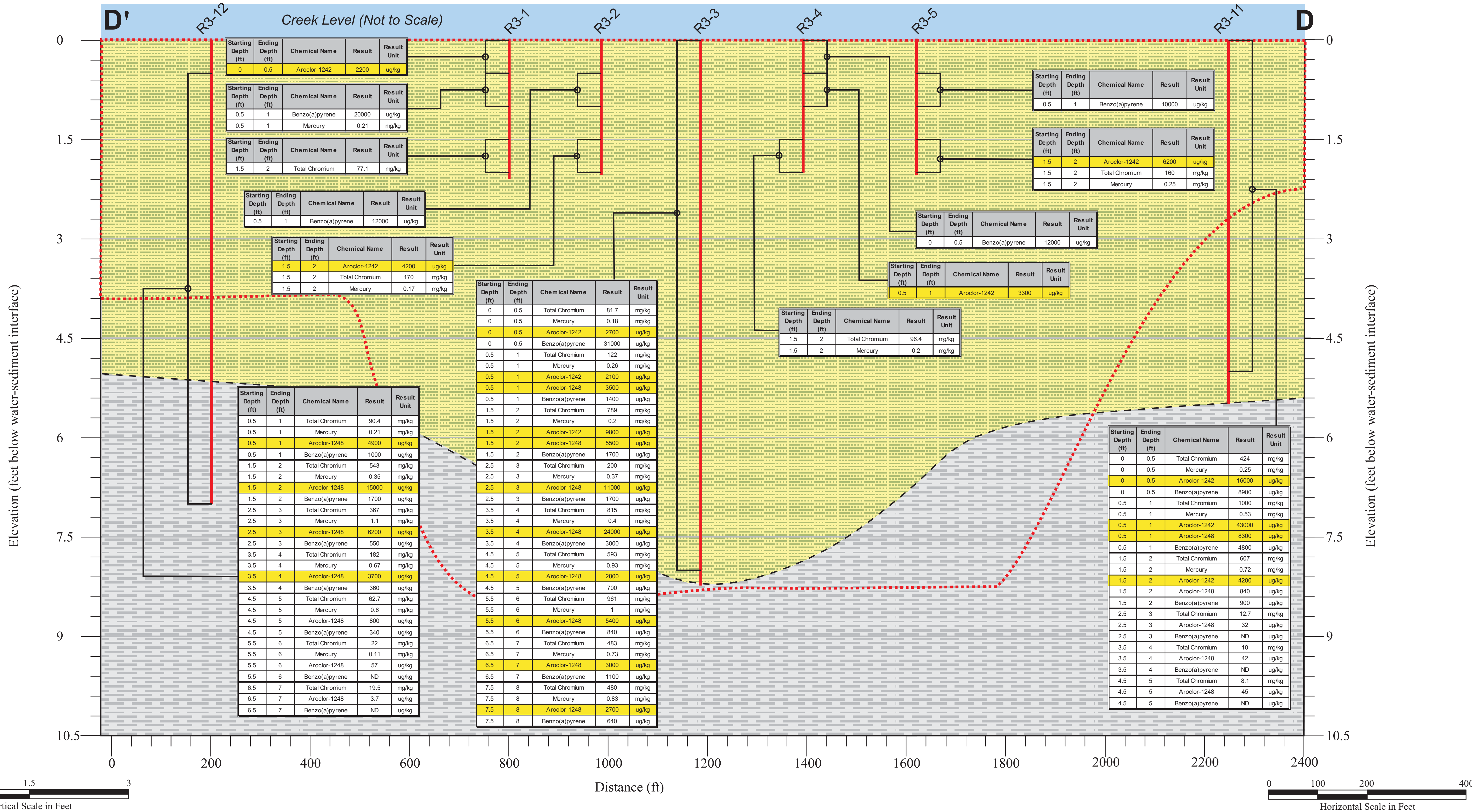
Sand/Silt and Organics

Silt and Clay

Notes:
Included data tables represent maximum concentrations of major risk drivers per boring location.
Additional information is provided for deeper borings.
Highlighted data indicate concentrations above cleanup goals.

µg/kg=micrograms per kilogram
mg/kg=milligrams per kilogram
ft=feet

Figure 2.9
Lower Ley Creek Northern Upstream Cross Section C–C'



Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Aroclor-1242	2200	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	Benzo(a)pyrene	20000	ug/kg
0.5	1	Mercury	0.21	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1.5	2	Total Chromium	77.1	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	Benzo(a)pyrene	12000	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1.5	2	Aroclor-1242	4200	ug/kg
1.5	2	Total Chromium	170	mg/kg
1.5	2	Mercury	0.17	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	Total Chromium	90.4	mg/kg
0.5	1	Mercury	0.21	mg/kg
0.5	1	Aroclor-1248	4900	ug/kg
0.5	1	Benzo(a)pyrene	1000	ug/kg
1.5	2	Total Chromium	543	mg/kg
1.5	2	Mercury	0.35	mg/kg
1.5	2	Aroclor-1248	15000	ug/kg
1.5	2	Benzo(a)pyrene	1700	ug/kg
2.5	3	Total Chromium	367	mg/kg
2.5	3	Mercury	1.1	mg/kg
2.5	3	Aroclor-1248	6200	ug/kg
2.5	3	Benzo(a)pyrene	550	ug/kg
3.5	4	Total Chromium	182	mg/kg
3.5	4	Mercury	0.67	mg/kg
3.5	4	Aroclor-1248	3700	ug/kg
3.5	4	Benzo(a)pyrene	360	ug/kg
4.5	5	Total Chromium	62.7	mg/kg
4.5	5	Mercury	0.6	mg/kg
4.5	5	Aroclor-1248	800	ug/kg
4.5	5	Benzo(a)pyrene	340	ug/kg
5.5	6	Total Chromium	22	mg/kg
5.5	6	Mercury	0.11	mg/kg
5.5	6	Aroclor-1248	57	ug/kg
5.5	6	Benzo(a)pyrene	ND	ug/kg
6.5	7	Total Chromium	19.5	mg/kg
6.5	7	Aroclor-1248	3.7	ug/kg
6.5	7	Benzo(a)pyrene	ND	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Total Chromium	81.7	mg/kg
0	0.5	Mercury	0.18	mg/kg
0	0.5	Aroclor-1242	2700	ug/kg
0	0.5	Benzo(a)pyrene	31000	ug/kg
0.5	1	Total Chromium	122	mg/kg
0.5	1	Mercury	0.26	mg/kg
0.5	1	Aroclor-1242	2100	ug/kg
0.5	1	Aroclor-1248	3500	ug/kg
0.5	1	Benzo(a)pyrene	1400	ug/kg
1.5	2	Total Chromium	789	mg/kg
1.5	2	Mercury	0.2	mg/kg
1.5	2	Aroclor-1242	9800	ug/kg
1.5	2	Aroclor-1248	5500	ug/kg
1.5	2	Benzo(a)pyrene	1700	ug/kg
2.5	3	Total Chromium	200	mg/kg
2.5	3	Mercury	0.37	mg/kg
2.5	3	Aroclor-1248	11000	ug/kg
2.5	3	Benzo(a)pyrene	1700	ug/kg
3.5	4	Total Chromium	815	mg/kg
3.5	4	Mercury	0.4	mg/kg
3.5	4	Aroclor-1248	24000	ug/kg
3.5	4	Benzo(a)pyrene	3000	ug/kg
4.5	5	Total Chromium	593	mg/kg
4.5	5	Mercury	0.93	mg/kg
4.5	5	Aroclor-1248	2800	ug/kg
4.5	5	Benzo(a)pyrene	700	ug/kg
5.5	6	Total Chromium	961	mg/kg
5.5	6	Mercury	1	mg/kg
5.5	6	Aroclor-1248	5400	ug/kg
5.5	6	Benzo(a)pyrene	840	ug/kg
6.5	7	Total Chromium	483	mg/kg
6.5	7	Mercury	0.73	mg/kg
6.5	7	Aroclor-1248	3000	ug/kg
6.5	7	Benzo(a)pyrene	1100	ug/kg
7.5	8	Total Chromium	480	mg/kg
7.5	8	Mercury	0.83	mg/kg
7.5	8	Aroclor-1248	2700	ug/kg
7.5	8	Benzo(a)pyrene	640	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	Benzo(a)pyrene	10000	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1.5	2	Aroclor-1242	6200	ug/kg
1.5	2	Total Chromium	160	mg/kg
1.5	2	Mercury	0.25	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Benzo(a)pyrene	12000	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	Aroclor-1242	3300	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1.5	2	Total Chromium	96.4	mg/kg
1.5	2	Mercury	0.2	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Total Chromium	424	mg/kg
0	0.5	Mercury	0.25	mg/kg
0	0.5	Aroclor-1242	16000	ug/kg
0	0.5	Benzo(a)pyrene	8900	ug/kg
0.5	1	Total Chromium	1000	mg/kg
0.5	1	Mercury	0.53	mg/kg
0.5	1	Aroclor-1242	43000	ug/kg
0.5	1	Aroclor-1248	8300	ug/kg
0.5	1	Benzo(a)pyrene	4800	ug/kg
1.5	2	Total Chromium	607	mg/kg
1.5	2	Mercury	0.72	mg/kg
1.5	2	Aroclor-1242	4200	ug/kg
1.5	2	Aroclor-1248	840	ug/kg
1.5	2	Benzo(a)pyrene	900	ug/kg
2.5	3	Total Chromium	12.7	mg/kg
2.5	3	Aroclor-1248	32	ug/kg
2.5	3	Benzo(a)pyrene	ND	ug/kg
3.5	4	Total Chromium	10	mg/kg
3.5	4	Aroclor-1248	42	ug/kg
3.5	4	Benzo(a)pyrene	ND	ug/kg
4.5	5	Total Chromium	8.1	mg/kg
4.5	5	Aroclor-1248	45	ug/kg
4.5	5	Benzo(a)pyrene	ND	ug/kg

\\GST-SRV-01\hglgis\Ley_Creek_MSIW\FS\
Cross_section_D-D'.cdr
1/13/2014 CNL
Source: HGL

HGL HydroGeoLogic, Inc

Legend

Boring

R3-11 Sample Location Identification

Lithology Boundary

Estimated Extent of Sediment above Cleanup Goals

Stratigraphy Type:

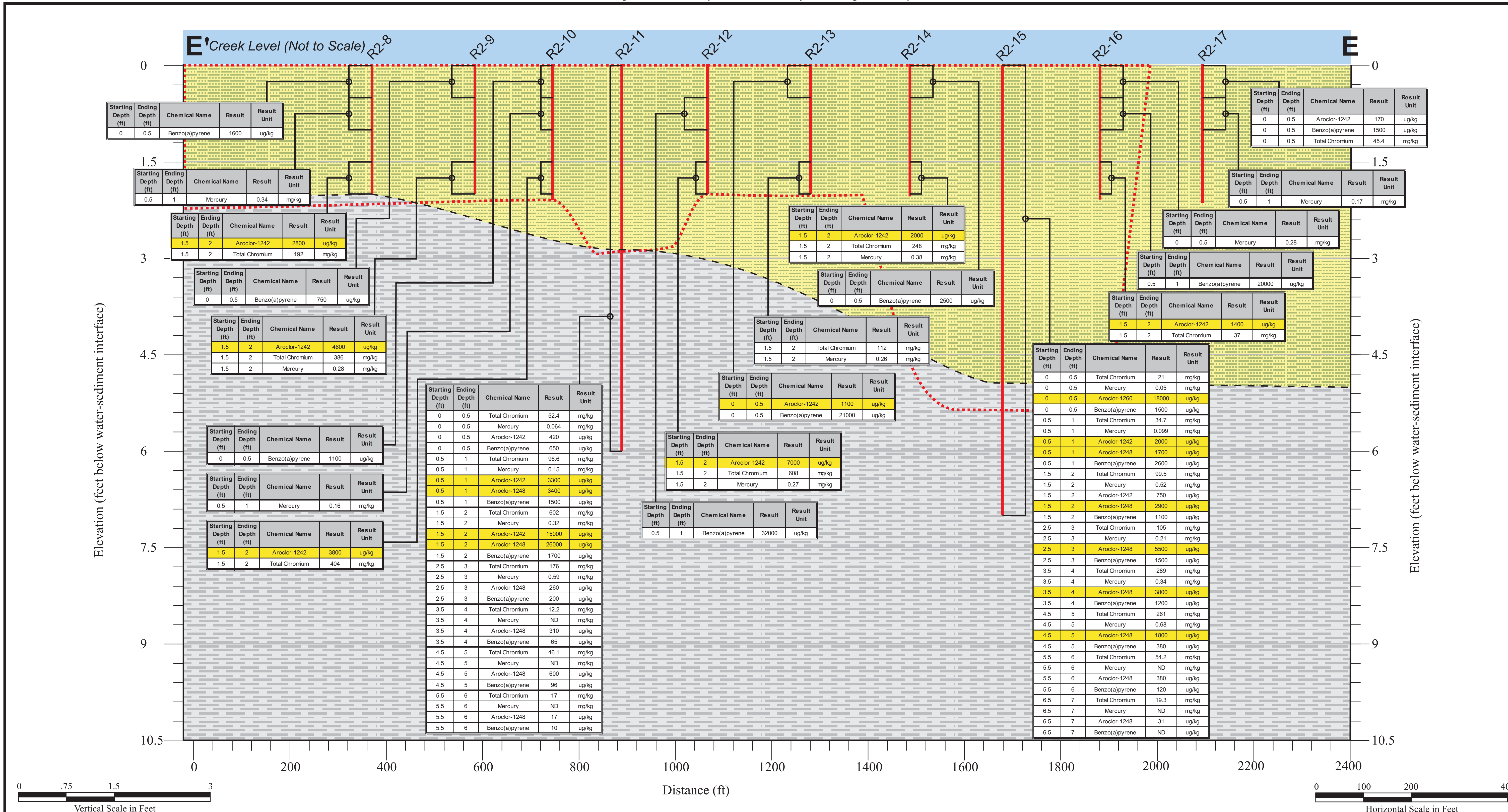
Sand/Silt and Organics

Silt and Clay

Notes:
Included data tables represent maximum concentrations of major risk drivers per boring location.
Additional information is provided for deeper borings.
Highlighted data indicate concentrations above cleanup goals.

µg/kg=micrograms per kilogram
mg/kg=milligrams per kilogram
ND=not detected
ft=feet

**Figure 2.10
Lower Ley Creek
Southern Upstream
Cross Section D–D'**



Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Benzo(a)pyrene	1600	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	Mercury	0.34	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1.5	2	Aroclor-1242	2800	ug/kg
1.5	2	Total Chromium	192	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Benzo(a)pyrene	750	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1.5	2	Aroclor-1242	4600	ug/kg
1.5	2	Total Chromium	386	mg/kg
1.5	2	Mercury	0.28	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Benzo(a)pyrene	1100	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	Mercury	0.16	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1.5	2	Aroclor-1242	3800	ug/kg
1.5	2	Total Chromium	404	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Total Chromium	52.4	mg/kg
0	0.5	Mercury	0.064	mg/kg
0	0.5	Aroclor-1242	420	ug/kg
0	0.5	Benzo(a)pyrene	650	ug/kg
0.5	1	Total Chromium	96.6	mg/kg
0.5	1	Mercury	0.15	mg/kg
0.5	1	Aroclor-1242	3300	ug/kg
0.5	1	Aroclor-1248	3400	ug/kg
0.5	1	Benzo(a)pyrene	1500	ug/kg
1.5	2	Total Chromium	602	mg/kg
1.5	2	Mercury	0.32	mg/kg
1.5	2	Aroclor-1242	15000	ug/kg
1.5	2	Aroclor-1248	26000	ug/kg
1.5	2	Benzo(a)pyrene	1700	ug/kg
2.5	3	Total Chromium	176	mg/kg
2.5	3	Mercury	0.59	mg/kg
2.5	3	Aroclor-1248	260	ug/kg
2.5	3	Benzo(a)pyrene	200	ug/kg
3.5	4	Total Chromium	12.2	mg/kg
3.5	4	Mercury	ND	mg/kg
3.5	4	Aroclor-1248	310	ug/kg
3.5	4	Benzo(a)pyrene	65	ug/kg
4.5	5	Total Chromium	46.1	mg/kg
4.5	5	Mercury	ND	mg/kg
4.5	5	Aroclor-1248	600	ug/kg
4.5	5	Benzo(a)pyrene	96	ug/kg
5.5	6	Total Chromium	17	mg/kg
5.5	6	Mercury	ND	mg/kg
5.5	6	Aroclor-1248	17	ug/kg
5.5	6	Benzo(a)pyrene	10	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	Benzo(a)pyrene	32000	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1.5	2	Aroclor-1242	7000	ug/kg
1.5	2	Total Chromium	608	mg/kg
1.5	2	Mercury	0.27	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Aroclor-1242	1100	ug/kg
0	0.5	Benzo(a)pyrene	21000	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1.5	2	Total Chromium	112	mg/kg
1.5	2	Mercury	0.26	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1.5	2	Aroclor-1242	2000	ug/kg
1.5	2	Total Chromium	248	mg/kg
1.5	2	Mercury	0.38	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Benzo(a)pyrene	2500	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Total Chromium	21	mg/kg
0	0.5	Mercury	0.05	mg/kg
0	0.5	Aroclor-1260	18000	ug/kg
0	0.5	Benzo(a)pyrene	1500	ug/kg
0.5	1	Total Chromium	34.7	mg/kg
0.5	1	Mercury	0.099	mg/kg
0.5	1	Aroclor-1242	2000	ug/kg
0.5	1	Aroclor-1248	1700	ug/kg
0.5	1	Benzo(a)pyrene	2600	ug/kg
1.5	2	Total Chromium	99.5	mg/kg
1.5	2	Mercury	0.52	mg/kg
1.5	2	Aroclor-1242	750	ug/kg
1.5	2	Aroclor-1248	2900	ug/kg
1.5	2	Benzo(a)pyrene	1100	ug/kg
2.5	3	Total Chromium	105	mg/kg
2.5	3	Mercury	0.21	mg/kg
2.5	3	Aroclor-1248	5500	ug/kg
2.5	3	Benzo(a)pyrene	1500	ug/kg
3.5	4	Total Chromium	289	mg/kg
3.5	4	Mercury	0.34	mg/kg
3.5	4	Aroclor-1248	3800	ug/kg
3.5	4	Benzo(a)pyrene	1200	ug/kg
4.5	5	Total Chromium	261	mg/kg
4.5	5	Mercury	0.68	mg/kg
4.5	5	Aroclor-1248	1800	ug/kg
4.5	5	Benzo(a)pyrene	380	ug/kg
5.5	6	Total Chromium	54.2	mg/kg
5.5	6	Mercury	ND	mg/kg
5.5	6	Aroclor-1248	380	ug/kg
5.5	6	Benzo(a)pyrene	120	ug/kg
6.5	7	Total Chromium	19.3	mg/kg
6.5	7	Mercury	ND	mg/kg
6.5	7	Aroclor-1248	31	ug/kg
6.5	7	Benzo(a)pyrene	ND	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
1.5	2	Aroclor-1242	1400	ug/kg
1.5	2	Total Chromium	37	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	Benzo(a)pyrene	20000	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Mercury	0.28	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0.5	1	Mercury	0.17	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Aroclor-1242	170	ug/kg
0	0.5	Benzo(a)pyrene	1500	ug/kg
0	0.5	Total Chromium	45.4	mg/kg

\\GST-SRV-01\hglgis\Ley_Creek_MSIW\FS\
Cross_section_E-E'.cdr
1/13/2014 CNL
Source: HGL

HGL HydroGeoLogic, Inc

Legend

- Boring
- R2-17 Sample Location Identification
- Lithology Boundary
- Estimated Extent of Sediment above Cleanup Goals

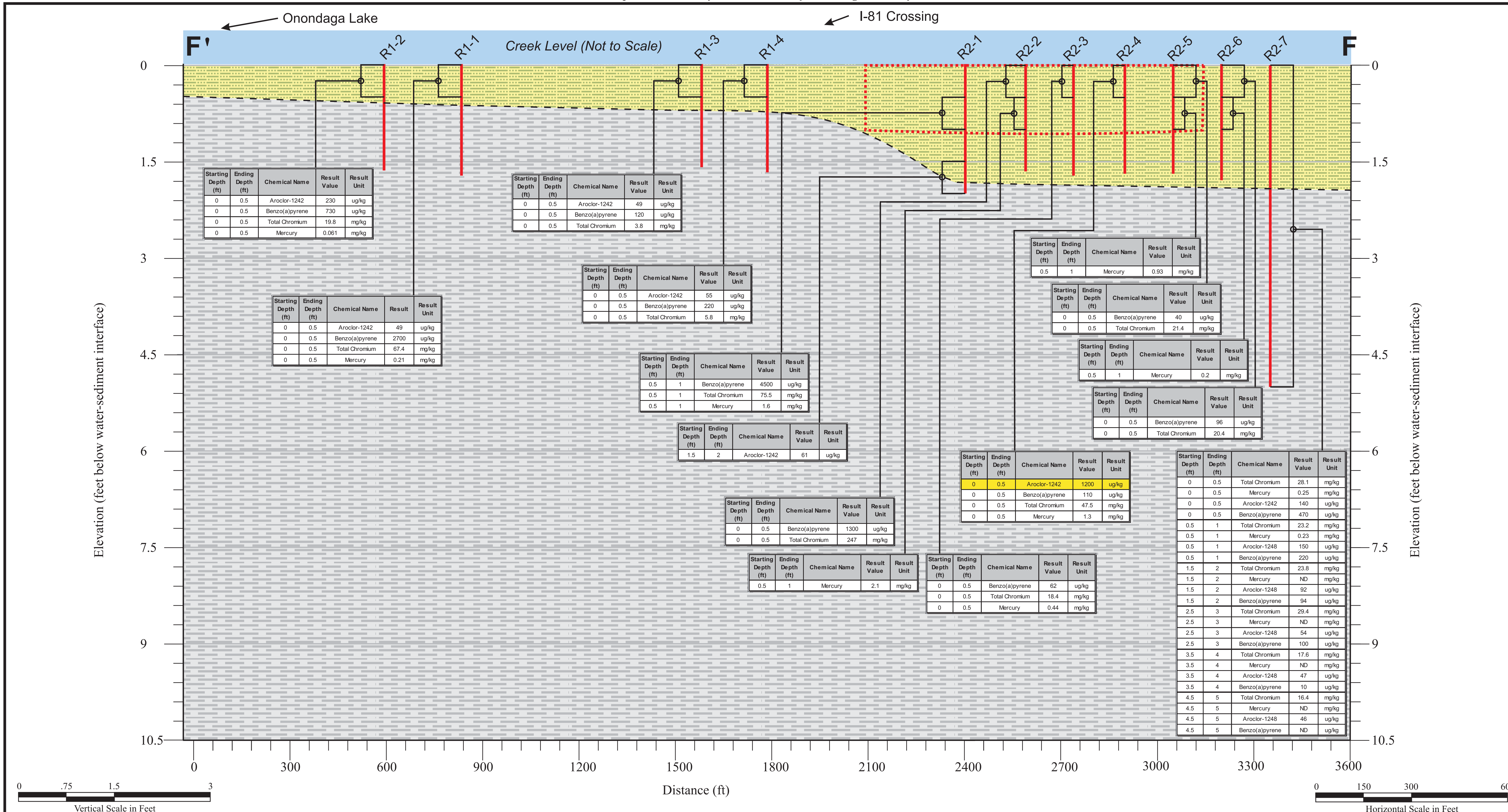
Stratigraphy Type:

- Sand/Silt and Organics
- Silt and Clay

Notes:
Included data tables represent maximum concentrations of major risk drivers per boring location.
Additional information is provided for deeper borings.
Highlighted data indicate concentrations above cleanup goals.

µg/kg=micrograms per kilogram
mg/kg=milligrams per kilogram
ND=not detected
ft=feet

Figure 2.11 Lower Ley Creek Middle Section Cross Section E–E'



Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result Value	Result Unit
0	0.5	Aroclor-1242	230	ug/kg
0	0.5	Benzo(a)pyrene	730	ug/kg
0	0.5	Total Chromium	19.8	mg/kg
0	0.5	Mercury	0.061	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result	Result Unit
0	0.5	Aroclor-1242	49	ug/kg
0	0.5	Benzo(a)pyrene	2700	ug/kg
0	0.5	Total Chromium	67.4	mg/kg
0	0.5	Mercury	0.21	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result Value	Result Unit
0	0.5	Aroclor-1242	49	ug/kg
0	0.5	Benzo(a)pyrene	120	ug/kg
0	0.5	Total Chromium	3.8	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result Value	Result Unit
0	0.5	Aroclor-1242	55	ug/kg
0	0.5	Benzo(a)pyrene	220	ug/kg
0	0.5	Total Chromium	5.8	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result Value	Result Unit
0.5	1	Benzo(a)pyrene	4500	ug/kg
0.5	1	Total Chromium	75.5	mg/kg
0.5	1	Mercury	1.6	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result Value	Result Unit
1.5	2	Aroclor-1242	61	ug/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result Value	Result Unit
0	0.5	Benzo(a)pyrene	1300	ug/kg
0	0.5	Total Chromium	247	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result Value	Result Unit
0.5	1	Mercury	2.1	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result Value	Result Unit
0	0.5	Benzo(a)pyrene	62	ug/kg
0	0.5	Total Chromium	18.4	mg/kg
0	0.5	Mercury	0.44	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result Value	Result Unit
0	0.5	Aroclor-1242	1200	ug/kg
0	0.5	Benzo(a)pyrene	110	ug/kg
0	0.5	Total Chromium	47.5	mg/kg
0	0.5	Mercury	1.3	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result Value	Result Unit
0.5	1	Mercury	0.93	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result Value	Result Unit
0	0.5	Benzo(a)pyrene	40	ug/kg
0	0.5	Total Chromium	21.4	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result Value	Result Unit
0.5	1	Mercury	0.2	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result Value	Result Unit
0	0.5	Benzo(a)pyrene	96	ug/kg
0	0.5	Total Chromium	20.4	mg/kg

Starting Depth (ft)	Ending Depth (ft)	Chemical Name	Result Value	Result Unit
0	0.5	Total Chromium	28.1	mg/kg
0	0.5	Mercury	0.25	mg/kg
0	0.5	Aroclor-1242	140	ug/kg
0	0.5	Benzo(a)pyrene	470	ug/kg
0.5	1	Total Chromium	23.2	mg/kg
0.5	1	Mercury	0.23	mg/kg
0.5	1	Aroclor-1248	150	ug/kg
0.5	1	Benzo(a)pyrene	220	ug/kg
1.5	2	Total Chromium	23.8	mg/kg
1.5	2	Mercury	ND	mg/kg
1.5	2	Aroclor-1248	92	ug/kg
1.5	2	Benzo(a)pyrene	94	ug/kg
2.5	3	Total Chromium	29.4	mg/kg
2.5	3	Mercury	ND	mg/kg
2.5	3	Aroclor-1248	54	ug/kg
2.5	3	Benzo(a)pyrene	100	ug/kg
3.5	4	Total Chromium	17.6	mg/kg
3.5	4	Mercury	ND	mg/kg
3.5	4	Aroclor-1248	47	ug/kg
3.5	4	Benzo(a)pyrene	10	ug/kg
4.5	5	Total Chromium	16.4	mg/kg
4.5	5	Mercury	ND	mg/kg
4.5	5	Aroclor-1248	46	ug/kg
4.5	5	Benzo(a)pyrene	ND	ug/kg

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Cross_section_F-F'.cdr
1/13/2014 CNL
Source: HGL

Legend

Boring

R2-7 Sample Location Identification

Lithology Boundary

Estimated Extent of Sediment above Cleanup Goals

Stratigraphy Type:

Sand/Silt and Organics

Silt and Clay

Notes:
Included data tables represent maximum concentrations of major risk drivers per boring location.
Additional information is provided for deeper borings.
Highlighted data indicate concentrations above cleanup goals.

µg/kg=micrograms per kilogram
mg/kg=milligrams per kilogram
ND=not detected
ft=feet

HGL HydroGeoLogic, Inc

Figure 2.12
Lower Ley Creek Downstream Section Cross Section F–F'

HGL—FS Report
Lower Ley Creek Subsite of Onondaga Lake, Syracuse, NY

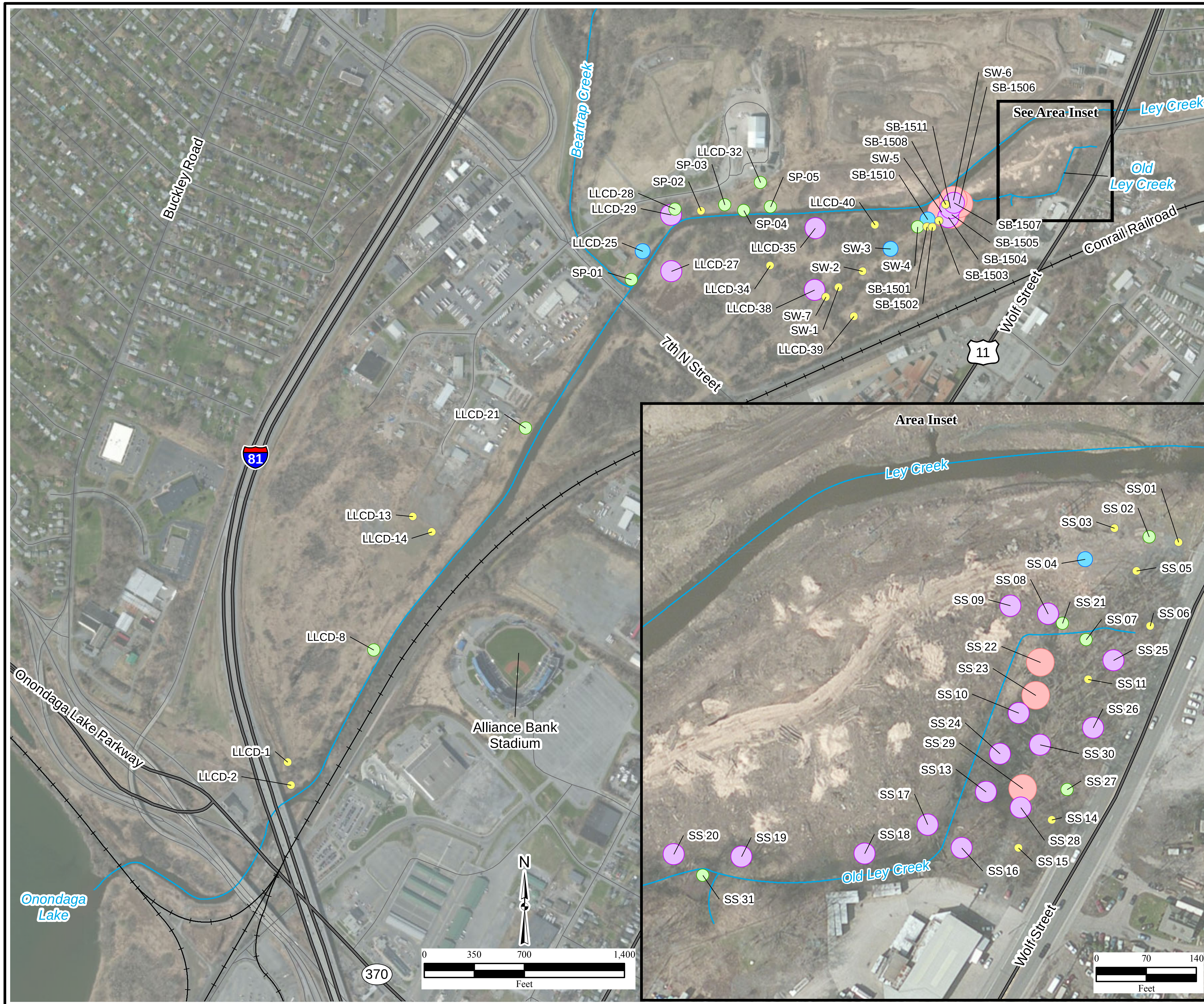


Figure 2.13
Lower Ley Creek and Old Ley Creek PCB Concentrations in Surface Soil (0-2 Feet Below Ground Surface)

Legend

PCB Concentrations at Soil Sample Locations (µg/kg):

- ≤1,000
- >1,000–5,000
- >5,000–10,000
- >10,000–250,000
- >250,000

SP-04 Sample Location Identification

Surface Water Course

Road

Highway

Railroad

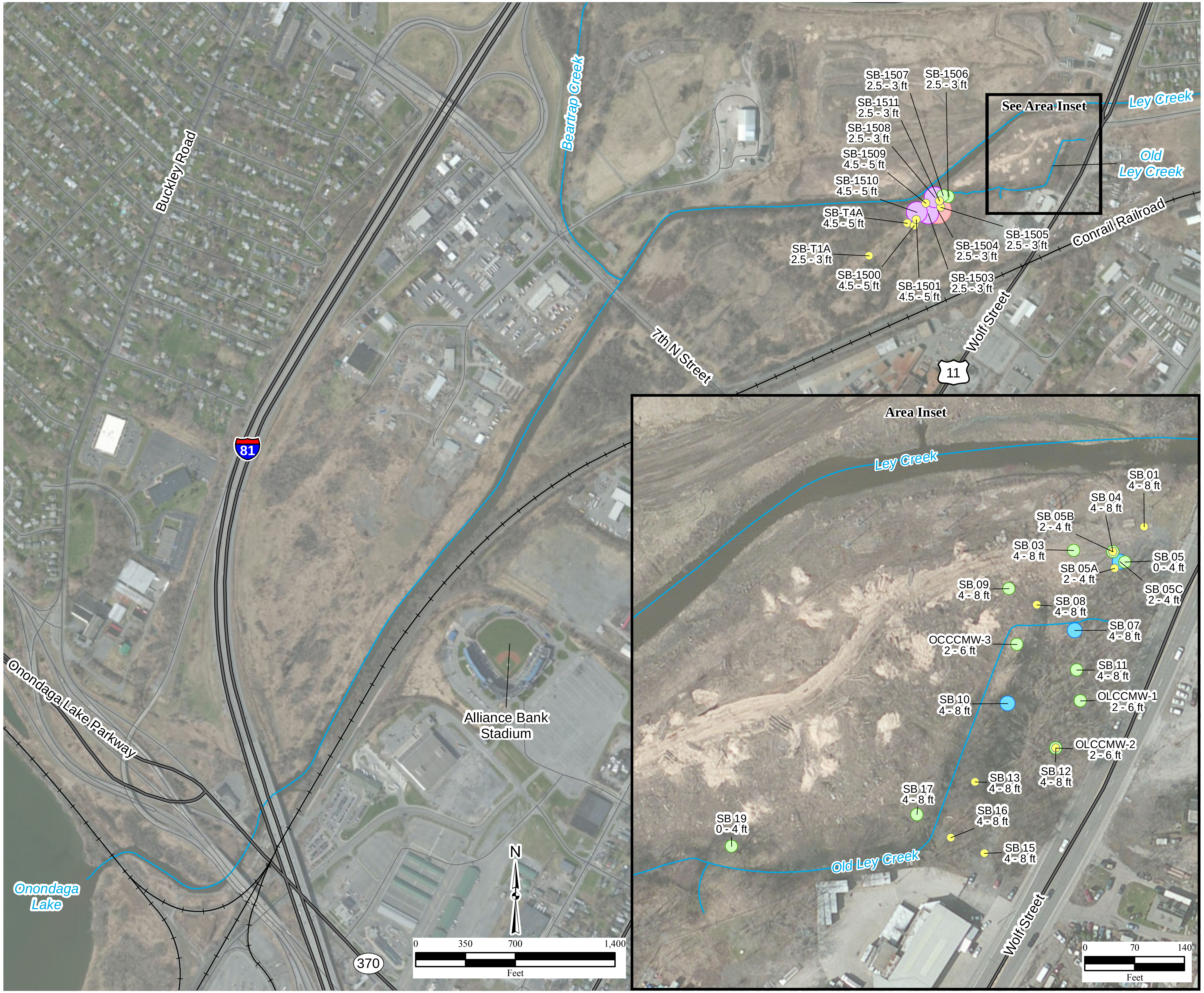
Notes:
Highest result (aroclor-1242, aroclor-1248, aroclor-1254, or aroclor-1260) is used for concentration value.

µg/kg=micrograms per kilogram
PCB=polychlorinated biphenyl

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS\(2-13)PCB_Surface.mxd
7/3/2013 CNL
Source: HGL, AE Engineering, ESRI, ArcGIS Online Imagery

HGL HydroGeoLogic, Inc

Figure 2.14
Lower Ley Creek and Old Ley Creek PCB Concentrations in Shallow Subsurface Soil



Legend

PCB Concentrations at Soil Sample Locations (µg/kg):

- ≤1,000
- >1,000–5,000
- >5,000–10,000
- >10,000–250,000
- >250,000

SB-04 4 - 8 ft — Sample Location Identification; Depth (Starting - Ending) in feet

- Surface Water Course
- Road
- Highway
- Railroad

Notes:
Highest result (aroclor-1242, aroclor-1248, aroclor-1254, or aroclor-1260) is used for concentration value.

µg/kg=micrograms per kilogram
PCB=polychlorinated biphenyl

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS\
(2-14)PCB_Shallow.mxd
7/3/2013 CNL
Source: HGL, AE Engineering, ESRI, ArcGIS Online Imagery

HGL HydroGeoLogic, Inc

Figure 2.15
Old Ley Creek PCB Concentrations in Deep Subsurface Soil

Legend

PCB Concentrations at Soil Sample Locations (µg/kg):

- ≤1,000
- >1,000–5,000
- >5,000–10,000
- >10,000–250,000
- >250,000

SB 04 12 - 14 ft — Sample Location Identification Depth (starting - ending) in feet

Surface Water Course

Road

Highway

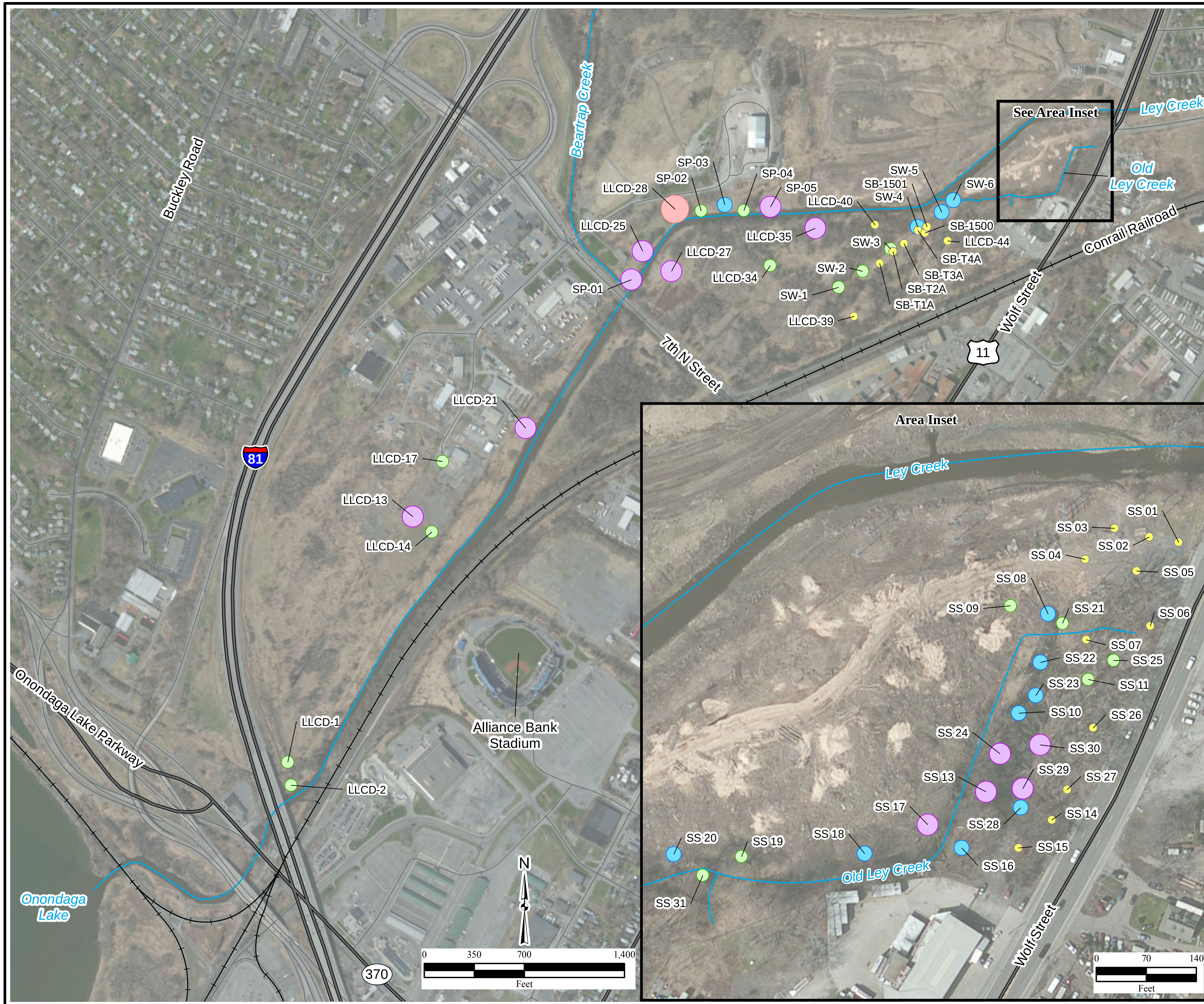
Railroad

Notes:
Highest result (aroclor-1242, aroclor-1248, aroclor-1254, or aroclor-1260) is used for concentration value.

µg/kg=micrograms per kilogram
PCB=polychlorinated biphenyl

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS\(2-15)PCB_Deep.mxd
7/3/2013 CNL
Source: HGL, AE Engineering, ESRI, ArcGIS Online Imagery

HGL HydroGeoLogic, Inc



HGL—FS Report
Lower Ley Creek Subsite of Onondaga Lake, Syracuse, NY

Figure 2.16
Lower Ley Creek and Old Ley Creek Mercury Concentrations in Surface Soil (0-2 Feet Below Ground Surface)

Legend

Mercury Concentrations at Soil Sample Locations (mg/kg):

- ≤0.18
- >0.18–0.4
- >0.4–0.8
- >0.8–2.8
- >2.8

SP-04 Sample Location Identification

Surface Water Course

Road

Highway

Railroad

Note:
mg/kg=milligrams per kilogram

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(2-16)Mercury_Surface.mxd
12/20/2013 CNL
Source: HGL, AE Engineering, ESRI, ArcGIS Online Imagery

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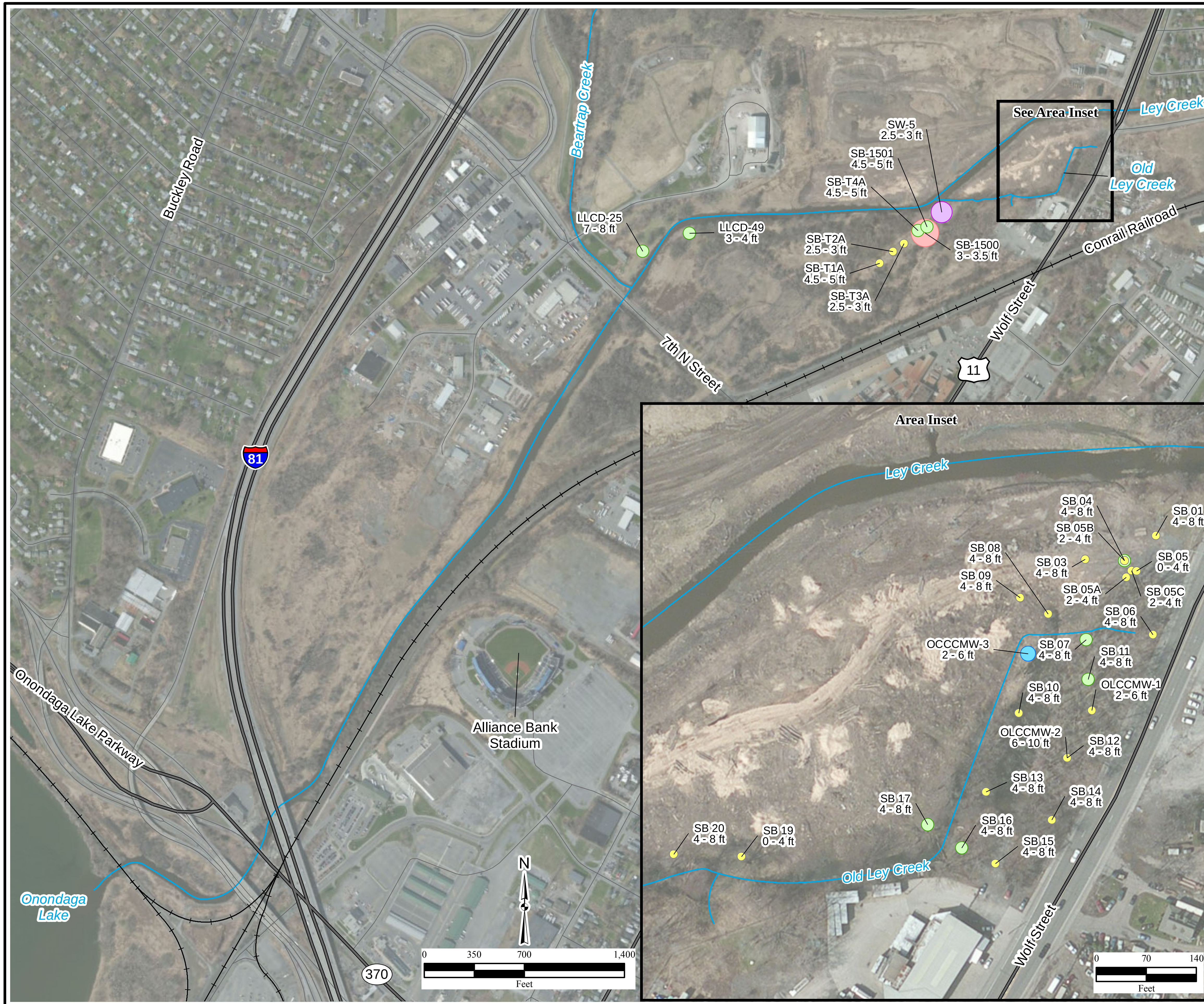
Figure 2.17
Lower Ley Creek and Old Ley Creek Mercury Concentrations in Shallow Subsurface Soil



Legend

Mercury Concentrations at Soil Sample Locations (mg/kg):

- ≤0.18
- >0.18–0.4
- >0.4–0.8
- >0.8–2.8
- >2.8

SB 01 / 4 - 8 ft — Sample Location Identification / Depth (starting - ending) in feet

Surface Water Course

Road

Highway

Railroad

Note:
mg/kg=milligrams per kilogram

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS\
(2-17)Mercury_Shallow.mxd
12/20/2013 CNL
Source: HGL, AE Engineering, ESRI,
ArcGIS Online Imagery

HGL HydroGeoLogic, Inc

Figure 2.18
Old Ley Creek
Mercury Concentrations in Deep Subsurface Soil

Legend

Mercury Concentrations at Soil Sample Locations (mg/kg):

- ≤0.18
- >0.18–0.4
- >0.4–0.8
- >0.8–2.8
- >2.8

SB 01 12 - 14 ft — Sample Location Identification, Depth (starting - ending) in feet

Surface Water Course

Road

Highway

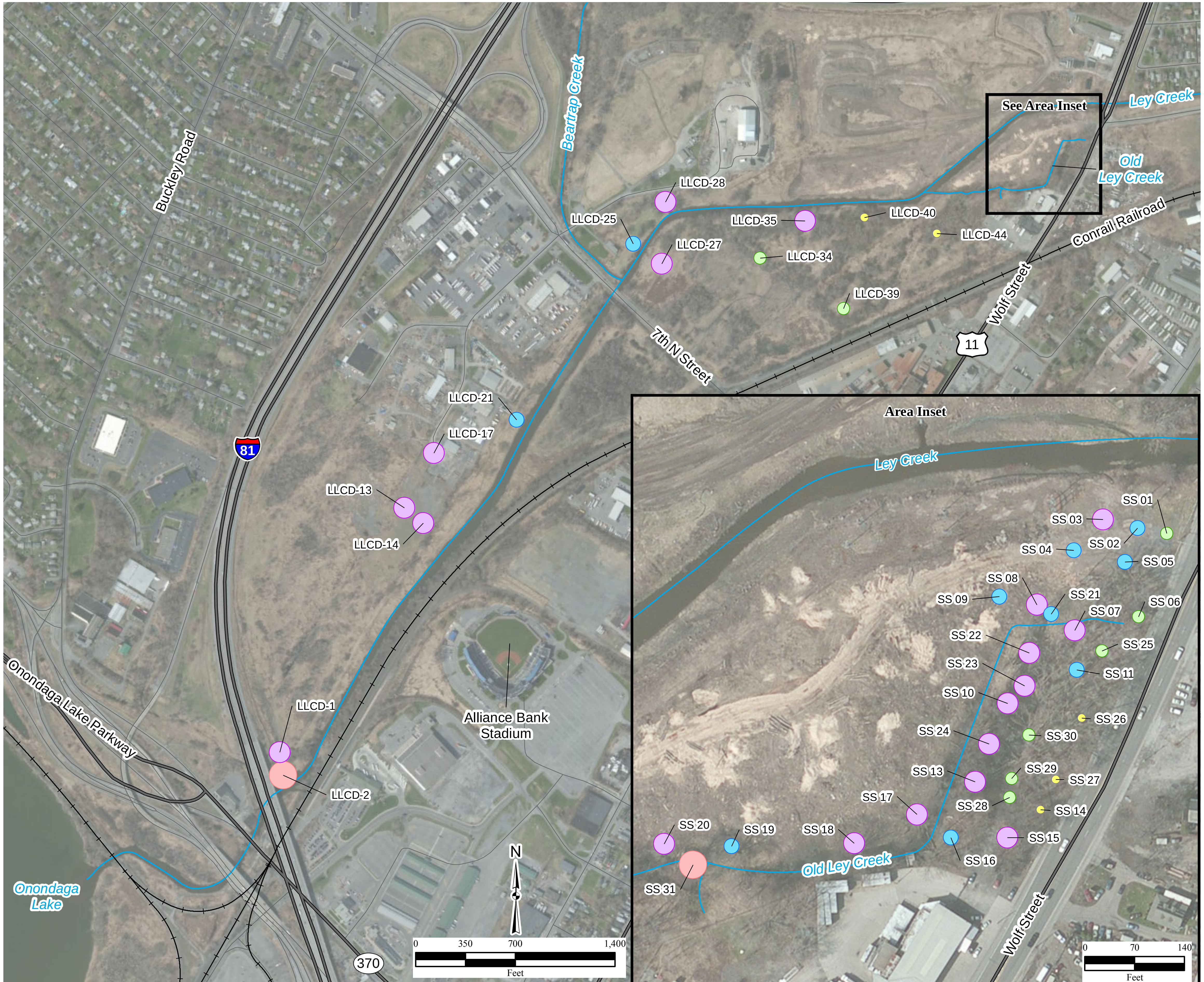
Railroad

Note:
mg/kg=milligrams per kilogram

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS\(2-18)Mercury_Deep.mxd
12/20/2013 CNL
Source: HGL, AE Engineering, ESRI, ArcGIS Online Imagery

HGL HydroGeoLogic, Inc

Figure 2.19
Lower Ley Creek and Old Ley Creek Benzo(a)pyrene Concentrations in Surface Soil (0-2 Feet Below Ground Surface)



Legend

Benzo(a)pyrene Concentrations at Soil Sample Locations (µg/kg):

- ≤500
- >500–1,000
- >1,000–2,000
- >2,000–6,000
- >6,000

SP-04 Sample Location Identification

Surface Water Course

Road

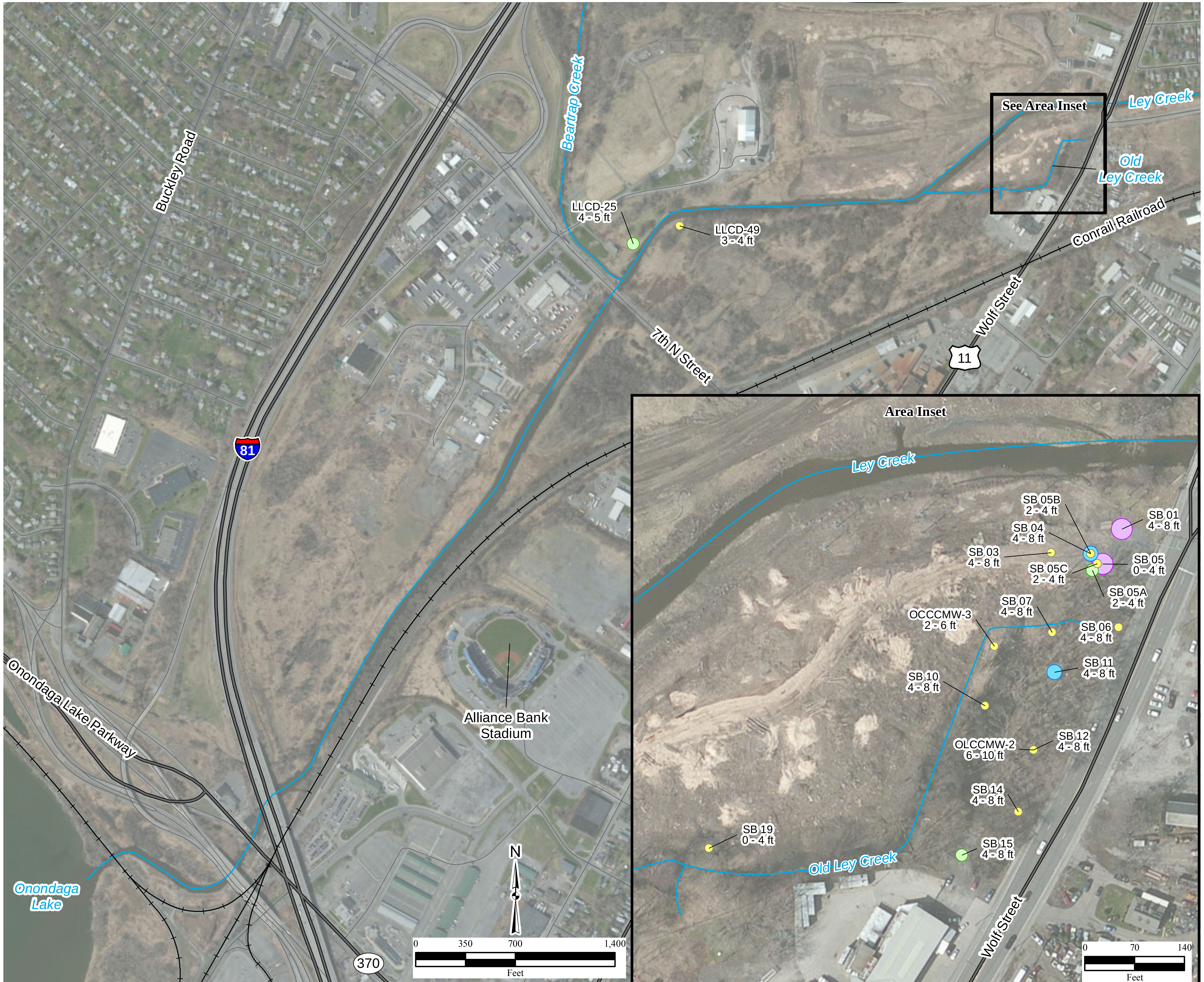
Highway

Railroad

Note:
µg/kg=micrograms per kilogram

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS\(2-19)Benzo(a)pyrene_Surface.mxd
7/3/2013 CNL
Source: HGL, AE Engineering, ESRI, ArcGIS Online Imagery

Figure 2.20
Lower Ley Creek and Old Ley Creek Benzo(a)pyrene Concentrations in Shallow Subsurface Soil



Legend

Benzo(a)pyrene Concentrations at Soil Sample Locations (µg/kg):

- ≤500
- >500–1,000
- >1,000–2,000
- >2,000–6,000
- >6,000

SB 01
4 - 8 ft — Sample Location Identification
Depth (starting - ending) in feet

Surface Water Course

Road

Highway

Railroad

Note:
µg/kg=micrograms per kilogram

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS\
(2-20)Benzo(a)pyrene_Shallow.mxd
7/3/2013 CNL
Source: HGL, AE Engineering, ESRI,
ArcGIS Online Imagery

HGL
HydroGeoLogic, Inc

HGL—FS Report
Lower Ley Creek Subsite of Onondaga Lake, Syracuse, NY

Figure 2.21
Old Ley Creek
Benzo(a)pyrene Concentrations in Deep Subsurface Soil

Legend

Benzo(a)pyrene Concentrations at Soil Sample Locations (µg/kg):

- ≤500
- >500–1,000
- >1,000–2,000
- >2,000–6,000
- >6,000

SB 04
12 - 14 ft
Sample Location Identification
Depth (starting-ending) in feet

Surface Water Course

Road

Highway

Railroad

Note:
µg/kg=micrograms per kilogram

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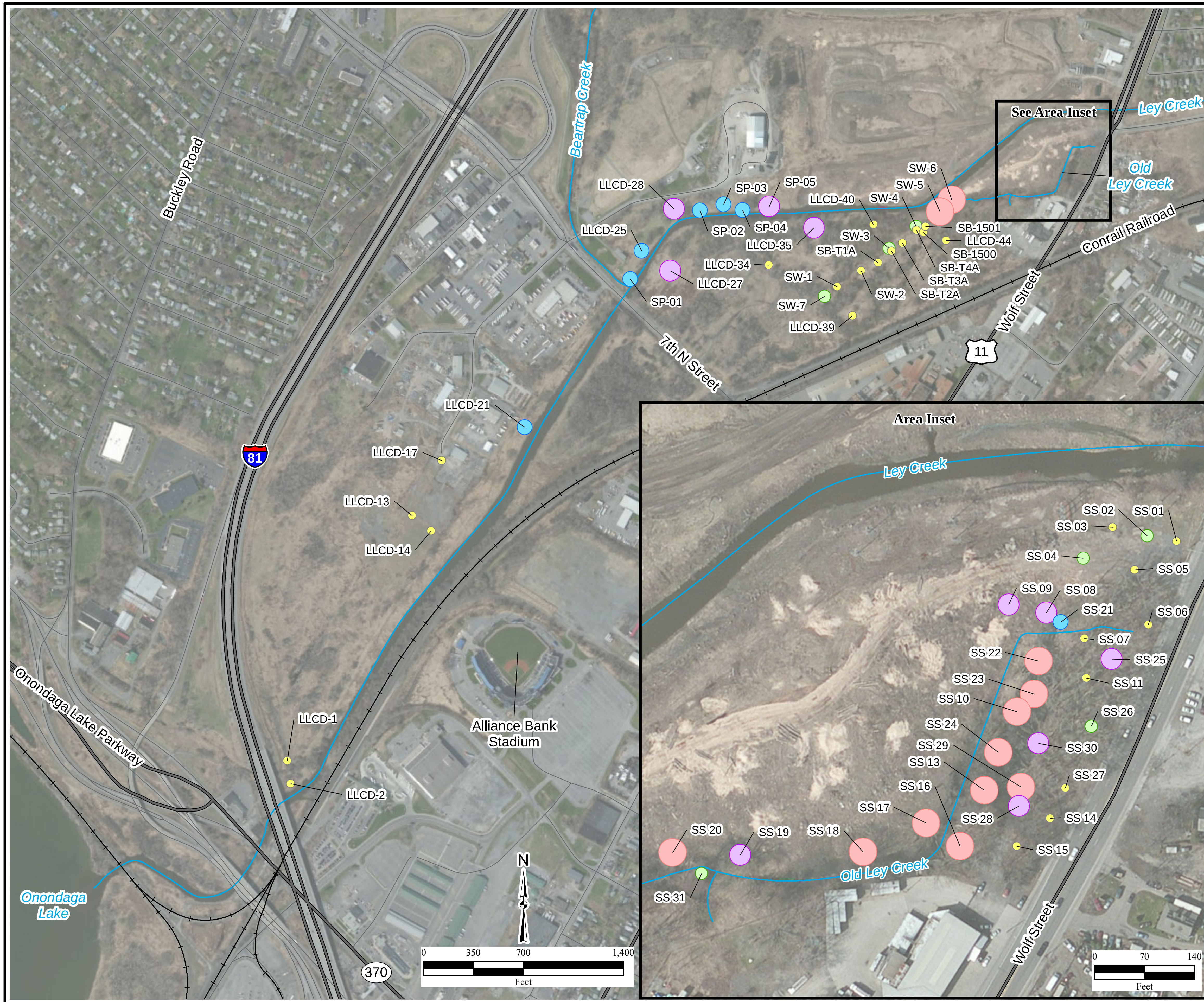
(2-21)Benzo(a)pyrene_Deep.mxd
7/3/2013 CNL
Source: HGL, AE Engineering, ESRI, ArcGIS Online Imagery

HGL HydroGeoLogic, Inc

Figure 2.22
Lower Ley Creek and Old Ley Creek Total Chromium Concentrations in Surface Soil (0-2 Feet Below Ground Surface)



Legend

Total Chromium Concentrations at Soil Sample Locations (mg/kg):

- ≤41
- >41–100
- >100–400
- >400–1,500
- >1,500

SP-04 Sample Location Identification

Surface Water Course

Road

Highway

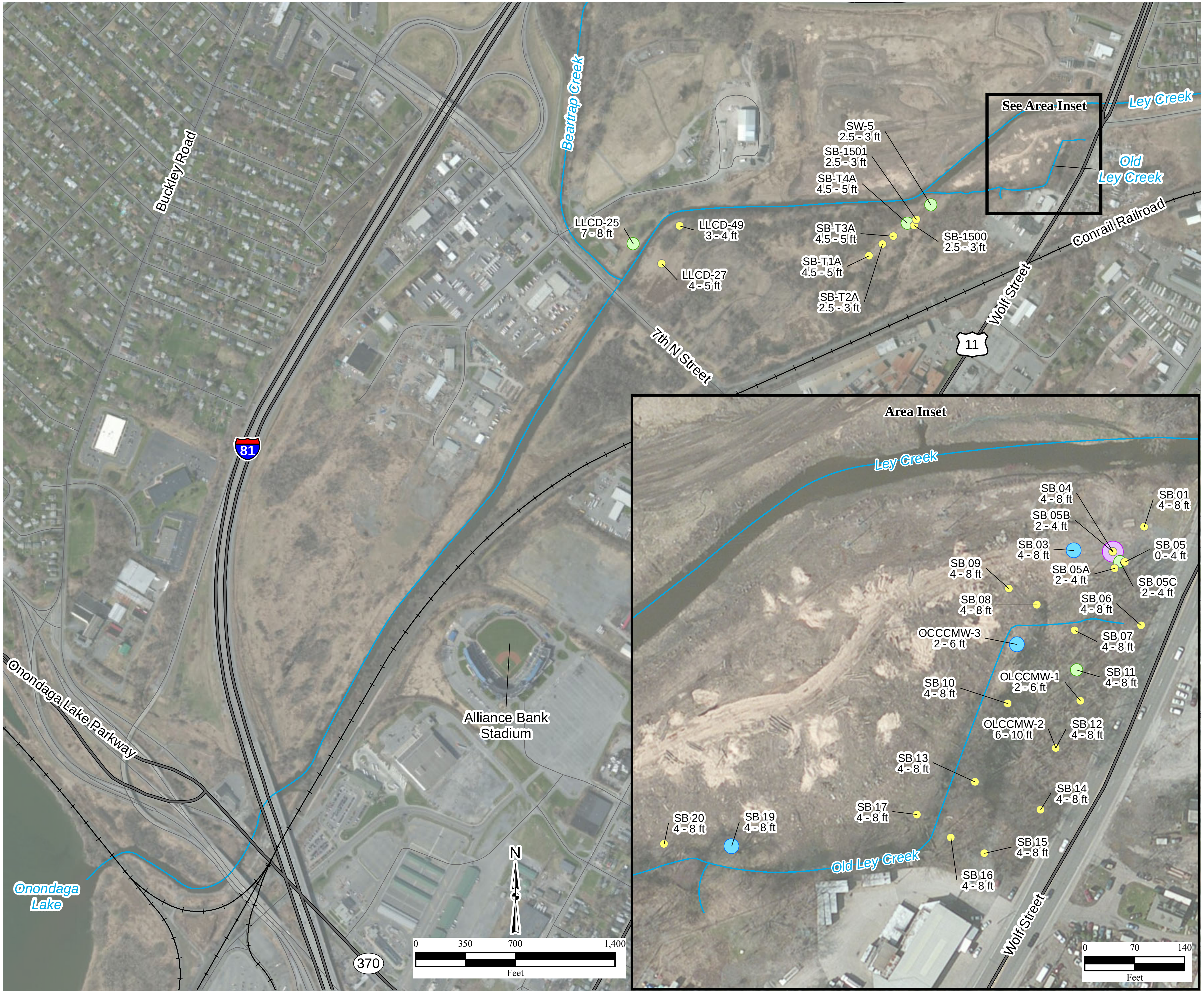
Railroad

Note:
mg/kg=milligrams per kilogram

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS\(2-22)Chromium_Surface.mxd
12/20/2013 CNL
Source: HGL, AE Engineering, ESRI, ArcGIS Online Bing Maps Aerial

HGL HydroGeoLogic, Inc

Figure 2.23
Lower Ley Creek and Old Ley Creek Total Chromium Concentrations in Shallow Subsurface Soil



Legend

Total Chromium Concentrations at Soil Sample Locations (mg/kg):

- ≤41
- >41–100
- >100–400
- >400–1,500
- >1,500

SB 04
4 - 8 ft — Sample Location Identification
Depth (starting - ending) in feet

Surface Water Course

Road

Highway

Railroad

Note:
mg/kg=milligrams per kilogram

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS
(2-23)Chromium_Shallow.mxd
12/20/2013 CNL
Source: HGL, AE Engineering, ESRI, ArcGIS Online Imagery

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HGL—FS Report
Lower Ley Creek Subsite of Onondaga Lake, Syracuse, NY

Figure 2.24
Old Ley Creek
Total Chromium Concentrations in Deep Subsurface Soil

Legend

Total Chromium Concentrations at Soil Sample Locations (mg/kg):

- ≤41
- >41–100
- >100–400
- >400–1,500
- >1,500

SB 04
12 - 14 ft
Sample Location Identification
Depth (starting - ending) in feet

Surface Water Course

Road

Highway

Railroad

Note:
mg/kg=milligrams per kilogram

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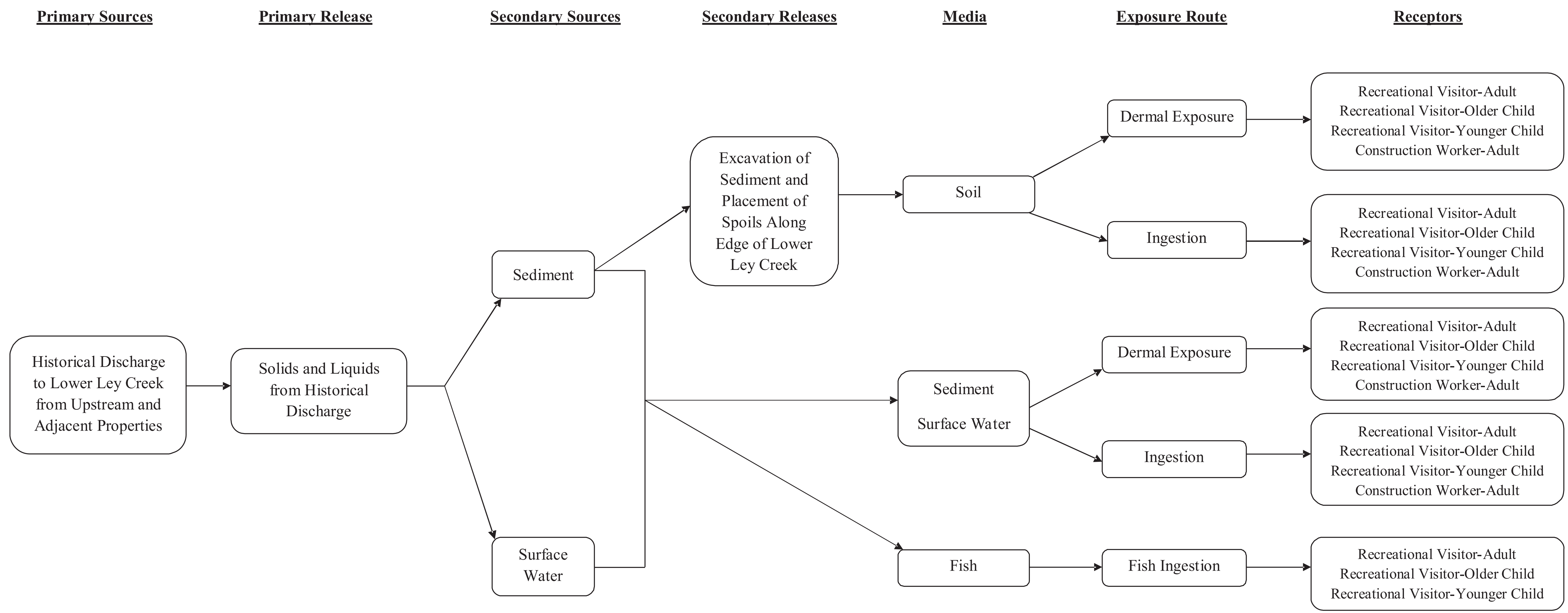
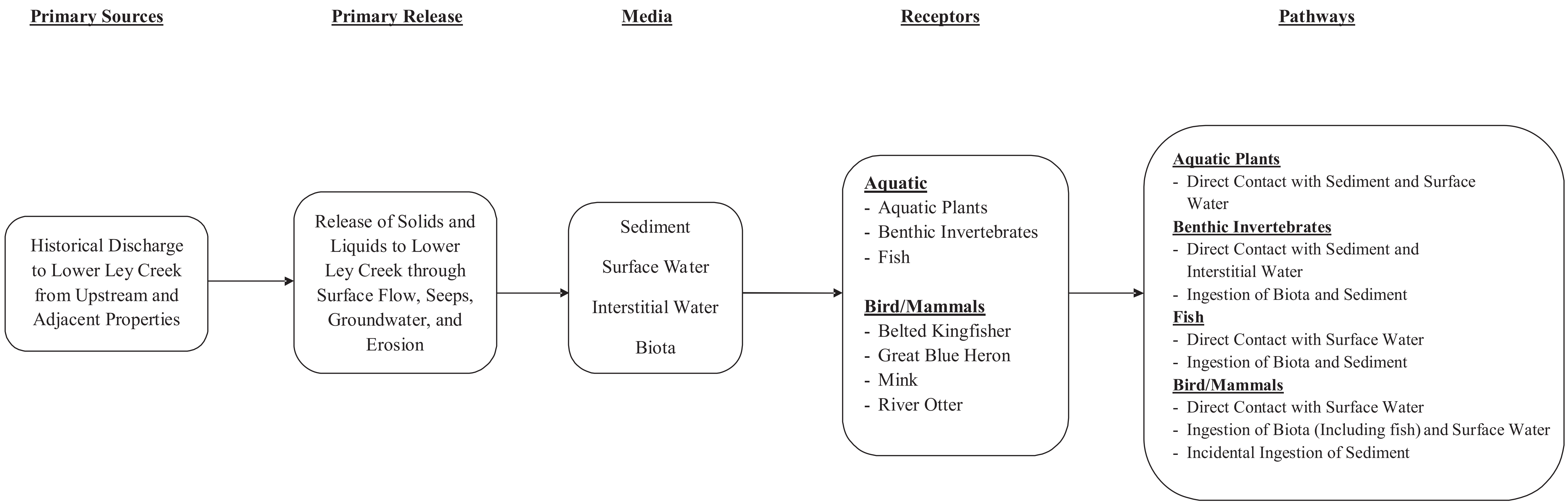
(2-24)Chromium_Deep.mxd
12/20/2013 CNL
Source: HGL, AE Engineering, ESRI,
ArcGIS Online Imagery

HGL HydroGeoLogic, Inc



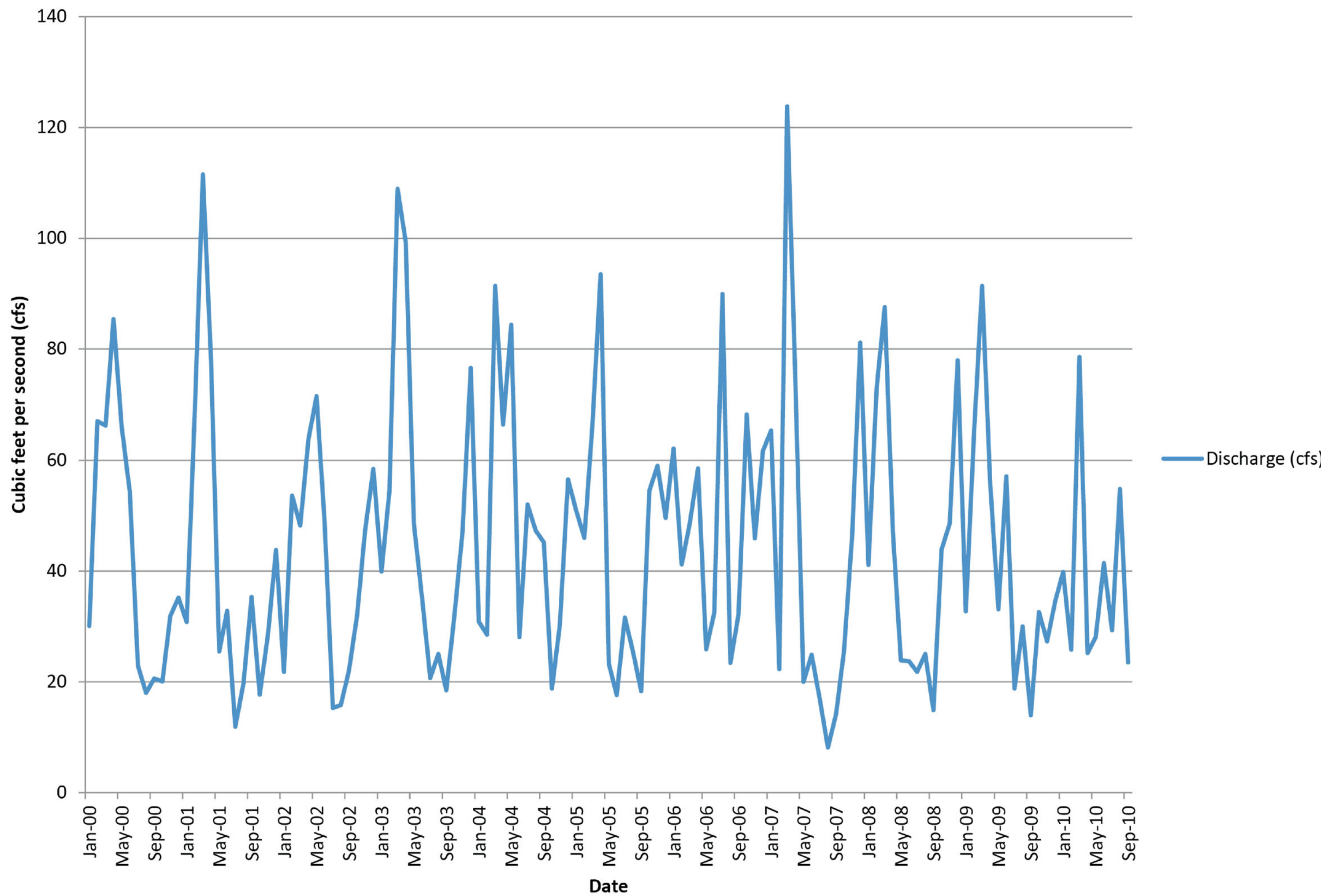
\\GST-SRV-01\hglgis\Ley_Creek_MSIW\FS
CSM-HHR.cdr
7/3/2013 CNL
Source: HGL

Figure 3.1
Conceptual Site Model for Human Health Risks



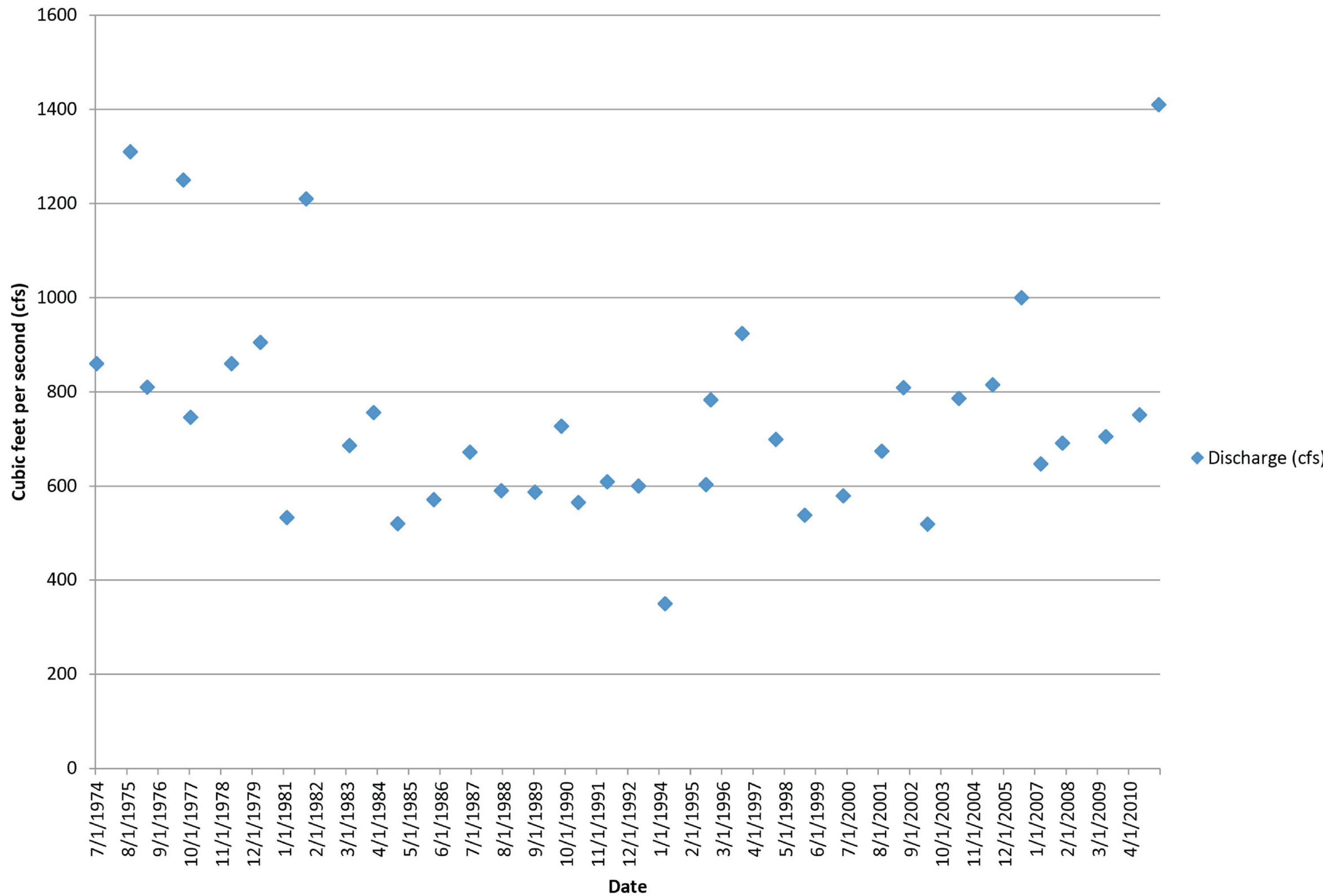
\\GST-SRV-01\hglgis\Ley_Creek_MSIW\FinalRI\
CSM-ER.cdr
7/3/2013 CNL
Source: HGL

Figure 3.2
Conceptual Site Model for Ecological Risks



\\GST-SRV-01\hglgis\Ley_Creek_MSIW\FS\
Streamflow_2000-10.cdr
7/3/2013 CNL
Source: HGL

Figure 4.1
Lower Ley Creek Streamflow Monthly Mean 2000–2010



\\GST-SRV-01\hglgis\Ley_Creek_MSIW\FS\
Streamflow_1974-2010.cdr
7/3/2013 CNL
Source: HGL

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Figure 4.2
Lower Ley Creek Streamflow Peak Flow 1974–2010

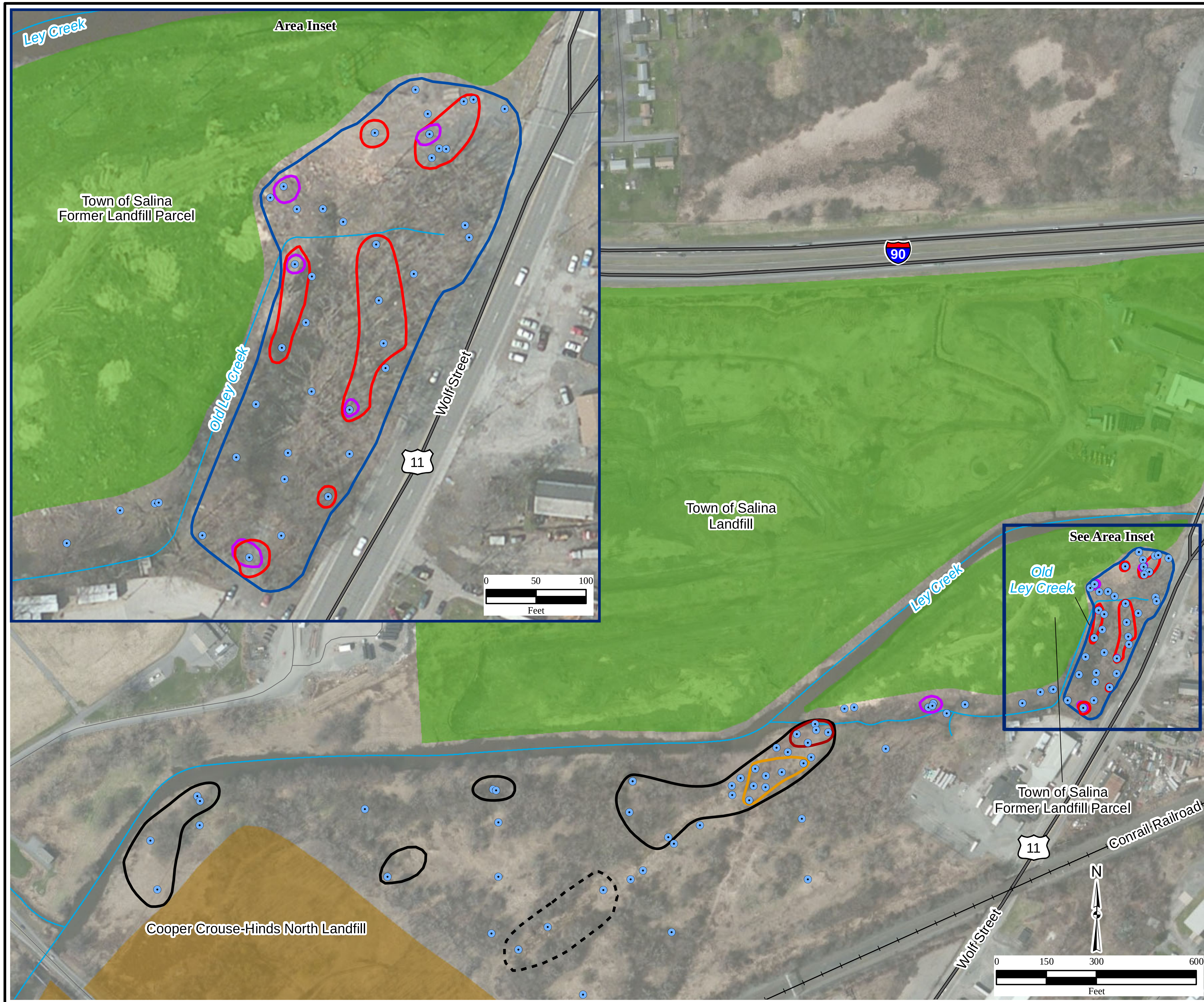


Figure 7.1
Soil Alternatives 2 and 3
Extent of Southern Swale
Soil Excavation

Legend

- Soil Sample Location
- Surface Water Course
- Road
- Highway
- Railroad
- 0.5 ft Excavation Extent 50,920 ft^2
- 2 ft Excavation Extent – Lower Ley Creek 157,270 ft^2
- 2 ft Excavation Extent – Old Ley Creek 81,894 ft^2
- 3 ft Excavation Extent 7,648 ft^2
- 5 ft Excavation Extent 14,462 ft^2
- 6 ft Excavation Extent 25,977 ft^2
- 8 ft Excavation Extent 12,755 ft^2
- 14 ft Excavation Extent 4,333 ft^2
- Cooper Crouse-Hinds Landfill
- Town of Salina Landfill and Former Landfill Parcel

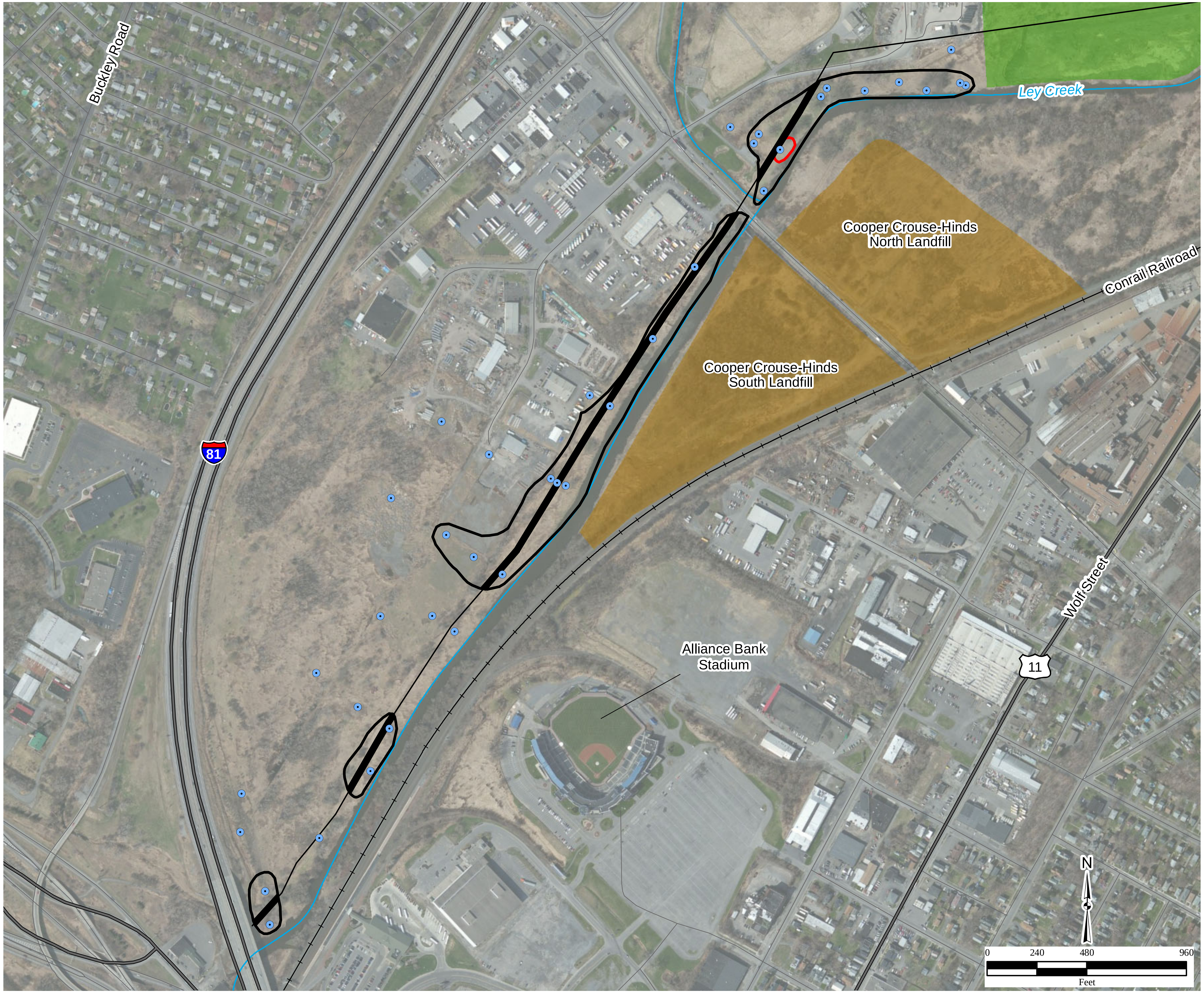
Notes:
PCB=polychlorinated biphenyl
ppm=part per million

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS\(7-01)SoilAlt23_SouthSwale.mxd
1/13/2014 CNL
Source: HGL, AE Engineering, ESRI, ArcGIS Online Imagery

HGL HydroGeoLogic, Inc

HGL—FS Report
Lower Ley Creek Subsite of Onondaga Lake, Syracuse, NY

Figure 7.2
Soil Alternative 2
Extent of Northwest
Soil Excavation



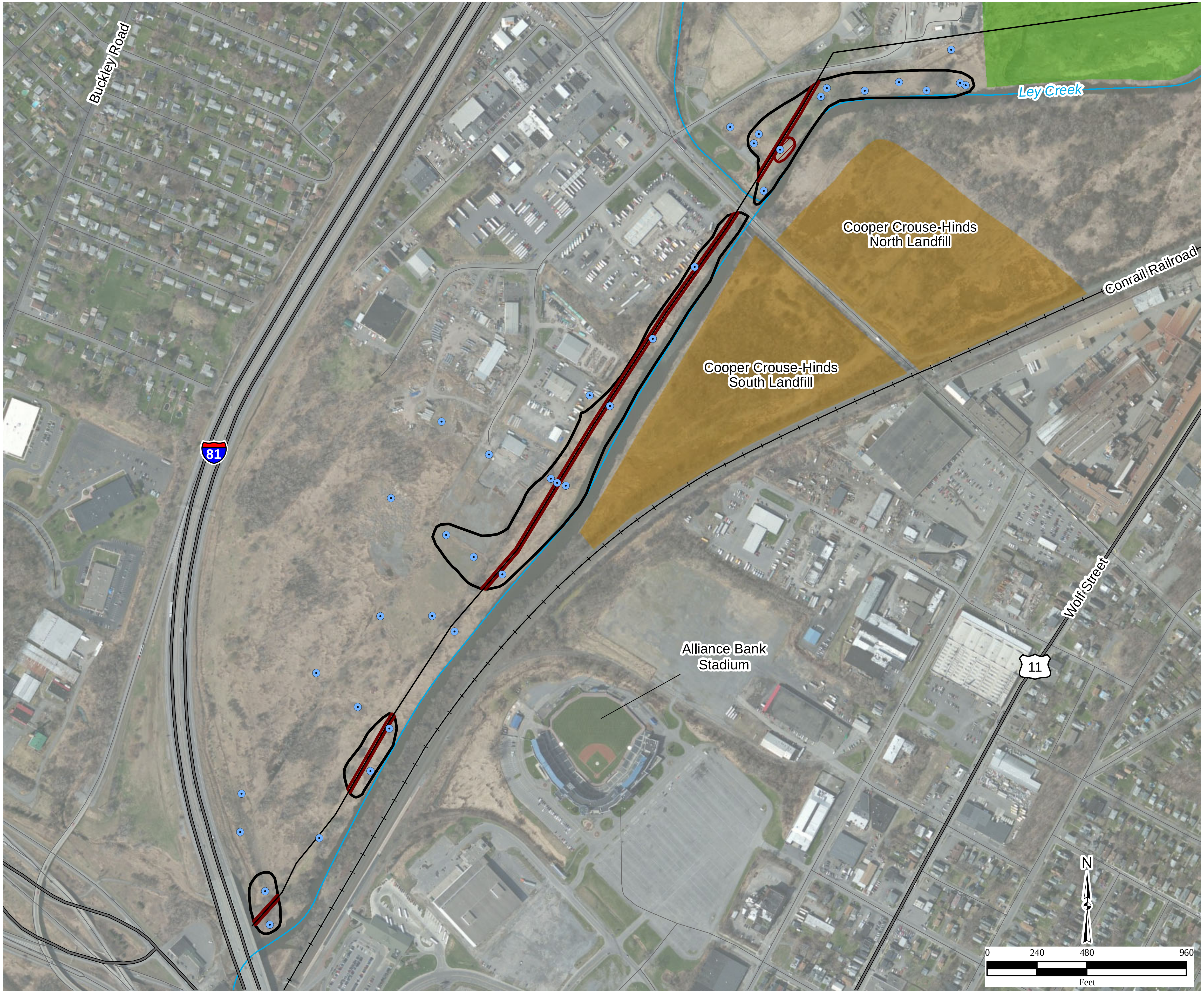
Legend

- Soil Sample Location
- Surface Water Course
- Road
- Highway
- Railroad
- Pipeline
- 2 ft Excavation Extent 642,044 ft^2
- 8 ft Excavation Extent 6,702 ft^2
- Area Around Pipeline Requiring Soil Cap 66,034 ft^2
- Cooper Crouse-Hinds Landfill
- Town of Salina Landfill and Former Landfill Parcel

Notes:
PCB=polychlorinated biphenyl
ppm=parts per million

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS\(7-02)SoilAlt2_NorthernSoils_PCB.mxd
1/13/2014 CNL
Source: HGL, AE Engineering, ESRI, ArcGIS Online Imagery

Figure 7.3
Soil Alternatives 3 and 4
Extent of Northwest
Soil Cap



Legend

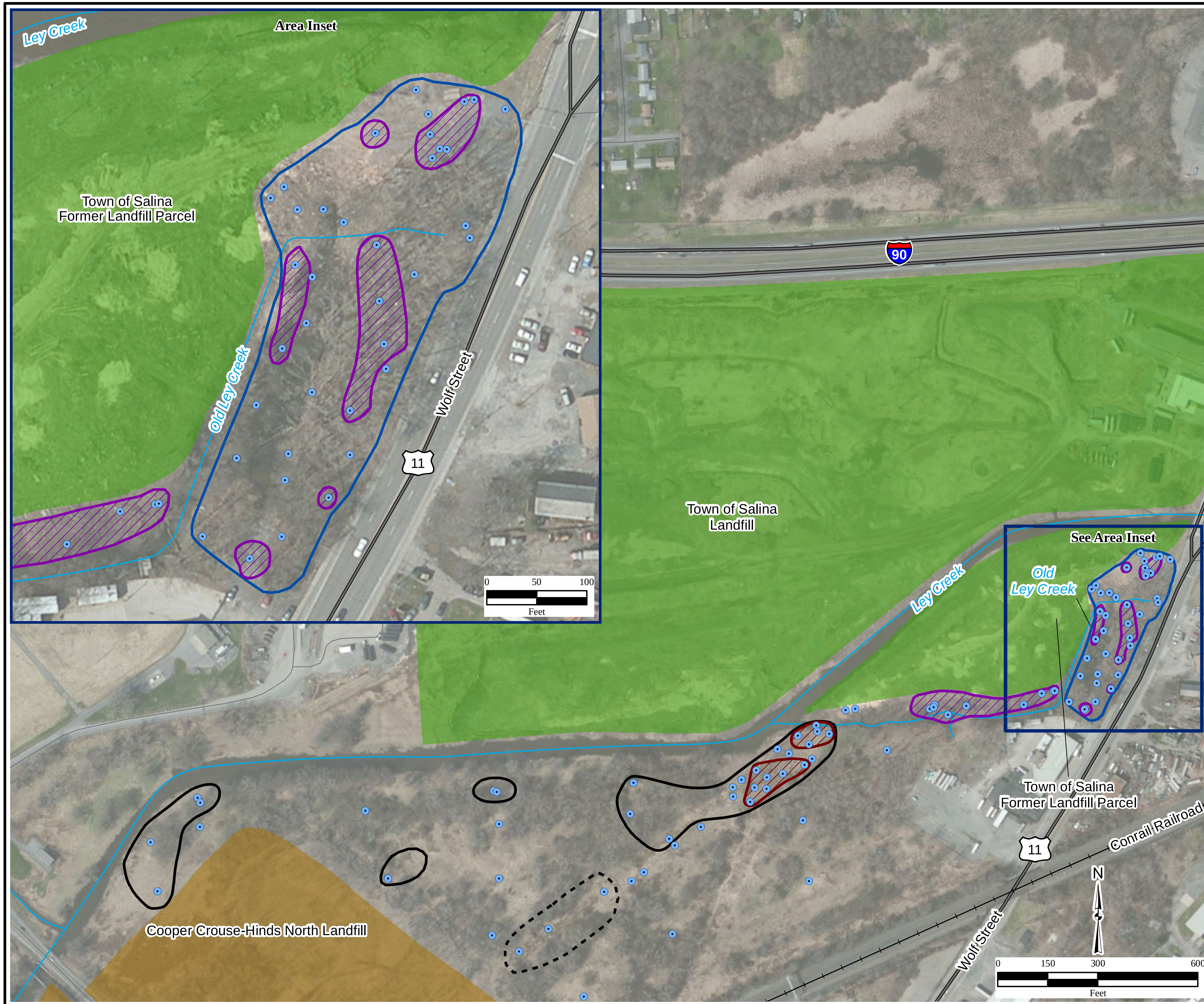
- Soil Sample Location
- Surface Water Course
- Road
- Highway
- Railroad
- Pipeline
- 2 ft Excavation Extent 576,010 ft^2
- Soil Cap Extent 72,736 ft^2
- Cooper Crouse-Hinds Landfill
- Town of Salina Landfill and Former Landfill Parcel

Notes:
PCB=polychlorinated biphenyl
ppm=parts per million

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS
(7-03)SoilAlt34_NorthernSoils_Cap.mxd
1/13/2014 CNL
Source: HGL, AE Engineering, ESRI,
ArcGIS Online Imagery

HGL HydroGeoLogic, Inc

Figure 7.4
Soil Alternative 4
Extent of Southern Swale
Soil Cap



Legend

- Soil Sample Location
- Surface Water Course
- Road
- Highway
- Railroad
- 0.5 ft Excavation Extent 50,920 ft^2
- 2 ft Excavation Extent – Lower Ley Creek 157,270 ft^2
- 2 ft Excavation Extent – Old Ley Creek 81,894 ft^2
- Soil Cap Extent – Lower Ley Creek 22,109 ft^2
- Soil Cap Extent – Old Ley Creek 39,731 ft^2
- Cooper Crouse-Hinds Landfill
- Town of Salina Landfill and Former Landfill Parcel

Notes:
PCB=polychlorinated biphenyl
ppm=part per million

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS
(7-04)SoilAlt4_SouthSwale.mxd
1/13/2014 CNL
Source: HGL, AE Engineering, ESRI,
ArcGIS Online Imagery

HGL HydroGeoLogic, Inc

HGL—FS Report
Lower Ley Creek Subsite of Onondaga Lake, Syracuse, NY

Figure 7.5
Sediment Alternative 2
Extent of Upstream Section Excavation

Legend

- Sediment Sample Location
- Surface Water Course
- Road
- Highway
- Railroad
- 2 ft Excavation Extent 93,066 ft^2
- 4 ft Excavation Extent 33,973 ft^2
- 8 ft Excavation Extent 119,482 ft^2

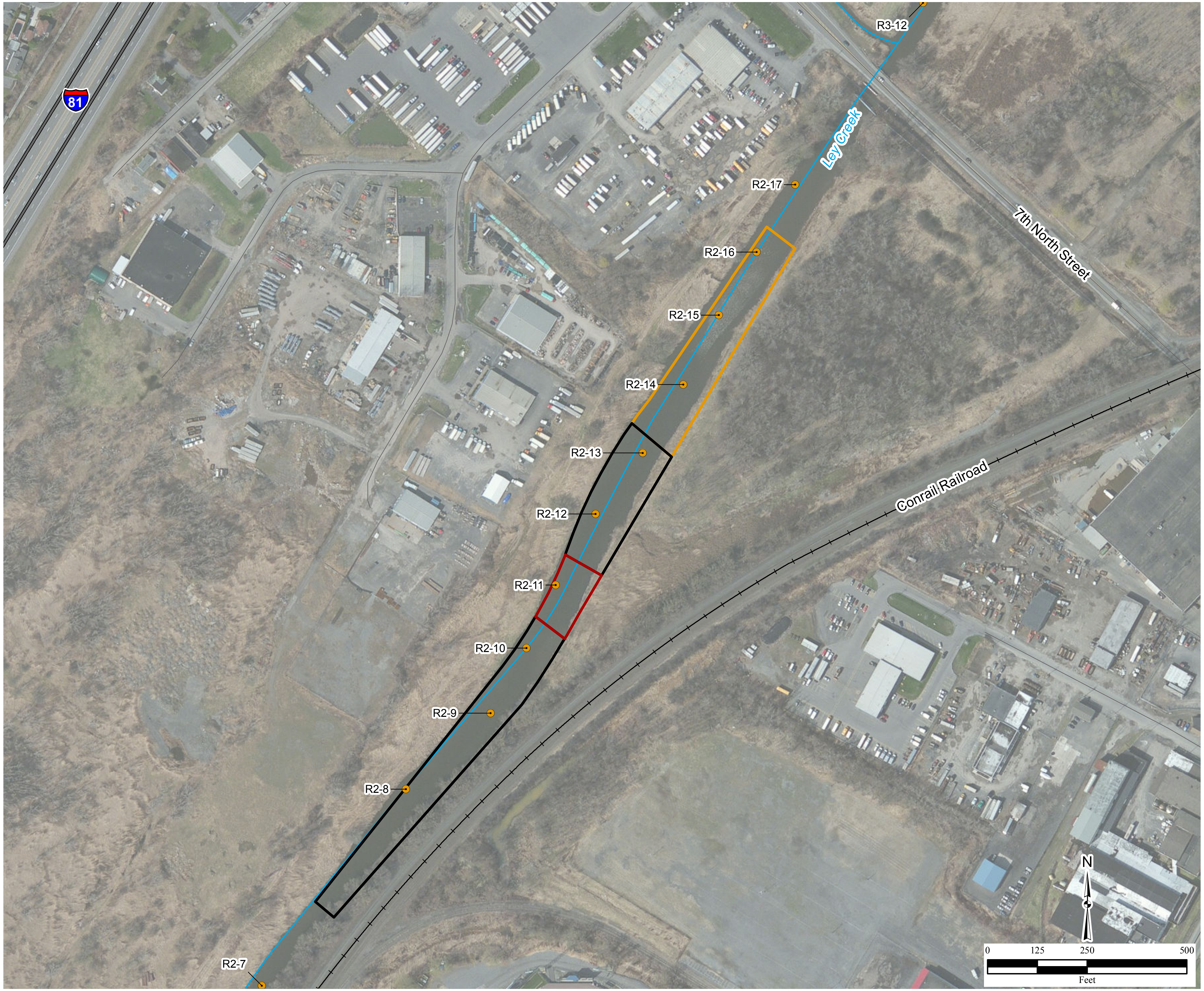
Notes:
PCB=polychlorinated biphenyl
ppm=parts per million

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS\(7-05)SedAlt2_Excav.mxd
8/5/2013 CNL
Source: HGL, AE Engineering, ESRI, ArcGIS Online Imagery

HGL HydroGeoLogic, Inc

HGL—FS Report
Lower Ley Creek Subsite of Onondaga Lake, Syracuse, NY

Figure 7.6
Sediment Alternative 2
Extent of Middle Section
Excavation



Legend

- Sediment Sample Location
- Surface Water Course
- Road
- Highway
- Railroad
- 2 ft Excavation Extent 119,978 ft^2
- 3 ft Excavation Extent 16,959 ft^2
- 5 ft Excavation Extent 65,029 ft^2

\\Gst-srv-01\hglgis\Ley_Creek_MSIW\FS\(7-06)SedAlt2_Excav.mxd
8/6/2013 CNL
Source: HGL, AE Engineering, ESRI, ArcGIS Online Imagery

HGL HydroGeoLogic, Inc

Figure 7.7
Sediment Alternatives 2, 3, and 4 Extent of Downstream Section Excavation

Legend

- Sediment Sample Location
- Surface Water Course
- Road
- Highway
- Railroad
- 1 ft Excavation Extent 69,697 ft^2

Notes:
PCB=polychlorinated biphenyl
ppm=parts per million

\\Gst-srv-01\hglgis\Ley_Creek_MSIW\FS
(7-07)SedAlt234_Downstream.mxd
8/6/2013 CNL
Source: HGL, AE Engineering, ESRI, ArcGIS Online Imagery

HGL HydroGeoLogic, Inc

HGL—FS Report
Lower Ley Creek Subsite of Onondaga Lake, Syracuse, NY

Figure 7.8
Sediment Alternative 3
Extent of Upstream Section
Sand/Armor Sediment Cap

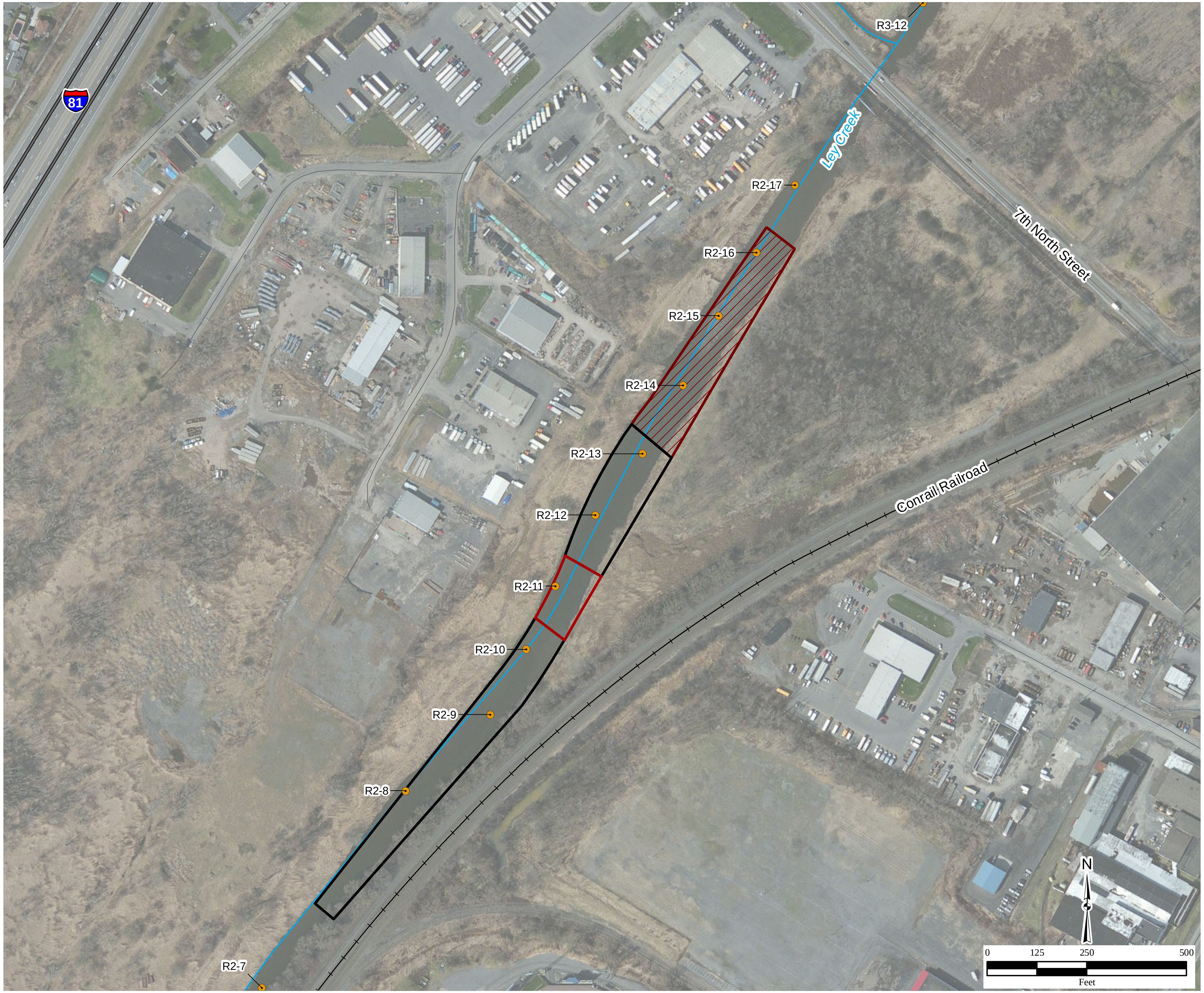
Legend

- Sediment Sample Location
- Surface Water Course
- Road
- Highway
- Railroad
- 2 ft Excavation Extent 93,066 ft^2
- 4 ft Excavation Extent 33,973 ft^2
- Armor Sediment Cap Extent 119,482 ft^2

Notes:
PCB=polychlorinated biphenyl
ppm=parts per million

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS\(7-08)SedAlt3_Cap.mxd
1/2/2014 CNL
Source: HGL, AE Engineering, ESRI, ArcGIS Online Imagery

Figure 7.9
Sediment Alternative 3
Extent of Middle Section
Sand/Armor Sediment Cap



Legend

- Sediment Sample Location
- Surface Water Course
- Road
- Highway
- Railroad
- 2 ft Excavation Extent 119,978 ft^2
- 3 ft Excavation Extent 16,959 ft^2
- Armor Sediment Cap Extent 65,029 ft^2

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS
(7-09)SedAlt3_Mid_Cap.mxd
1/2/2014 CNL
Source: HGL, AE Engineering, ESRI,
ArcGIS Online Imagery

HGL HydroGeoLogic, Inc

Figure 7.10
Sediment Alternative 4
Extent of Upstream Section
Bentonite Sediment Cap

Legend

- Sediment Sample Location
- Surface Water Course
- Road
- Highway
- Railroad
- Extent of Bentonite Sediment Cap 240,397 ft^2

Notes:
PCB=polychlorinated biphenyl
ppm=parts per million

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS\(7-10)SedAlt4_Upstream_Cap.mxd
8/5/2013 CNL
Source: HGL, AE Engineering, ESRI, ArcGIS Online Imagery

Figure 7.11
Sediment Alternative 4
Extent of Middle Section
Bentonite Sediment Cap

Legend

- Sediment Sample Location
- Surface Water Course
- Road
- Highway
- Railroad
- Extent of Bentonite Sediment Cap 203,559 ft^2

Notes:
PCB=polychlorinated biphenyl
ppm=parts per million

\\gst-srv-01\hglgis\Ley_Creek_MSIW\FS\ (7-11)SedAlt4_Mid_BentoniteCap.mxd
8/5/2013 CNL
Source: HGL, AE Engineering, ESRI, ArcGIS Online Imagery

TABLES

Table 3.1
Human Health Risk Concerns

Exposure Pathway/Media	Non-Cancer Risk		Cancer Risk	
	Exposure Risk	Primary COPCs	Exposure Risk	Primary COPCs
Sediments				
Recreational Visitor - Adult	Fish ingestion	PCBs and Total Chromium	Fish ingestion	PCBs, Total Chromium, and Arsenic
Recreational Vistor - Older Child (6 - <16 years old)	Fish ingestion and dermal exposure	PCBs and Total Chromium	Fish ingestion and dermal exposure	PCBs, Total Chromium, Arsenic, and Benzo(a)pyrene
Recreational Vistor - Younger Child (<6 years old)	Fish ingestion, dermal exposure, ingestion of sediment	PCBs, Total Chromium, Arsenic, and Mercury	Fish ingestion, dermal exposure, ingestion of sediment	PCBs, Total Chromium, Arsenic, and PAHs
Construction Worker - Adult	None	None	None	None
Soils				
Recreational Visitor - Adult	None	None	Direct contact (ingestion and dermal) with soils	Total Chromium and Benzo(a)pyrene
Recreational Vistor - Older Child (6 - <16 years old)	Dermal exposure	PCBs	Dermal exposure	Benzo(a)pyrene
Recreational Vistor - Younger Child (<6 years old)	Direct contact (ingestion and dermal) with soils	PCBs, Total Chromium, and Cadmium	Direct contact (ingestion and dermal) with soils	PCBs, PAHs, and Total Chromium
Construction Worker - Adult	Direct contact (ingestion and dermal) with soils	PCBs	Ingestion of soils	Total Chromium

Notes:

PCBs - polychlorinated biphenyls

COPCs - chemicals of potential concern

PAHs - polcyclic aromatic hydrocarbons

Table 4.1
Streamflow Characteristics in Lower Ley Creek

USGS Stream Gauge	USGS 04240120 LEY CREEK AT PARK STREET, SYRACUSE, NY
Period of Record	
Daily Discharge Data	1972-2011
Monthly Discharge Data	1972-2010
Annual Discharge Data	1973-2010
Peak Streamflow Information	1973-2011
Flow Characteristics	
Maximum average daily flow (cfs)	831
Maximum recorded peak flow (cfs)	1410
Date of maximum recorded peak flow	4/16/2011
Minimum average daily flow (cfs)	1.9

Table 5.1
Chemicals of Potential Concern
Contributing to Human Health and Ecological Risks in Lower Ley Creek

Chemicals of Potential Concern (COPCs)	Ecological Risk	Human Health Sediment Risk	Human Health Soil Risk
Metals			
Arsenic	X	X	
Cadmium	X		
Total Chromium	X	X	X
Copper	X		
Lead	X		
Nickel	X		
Mercury	X	X	
Silver	X		
Zinc	X		
Organic Compounds			
VOCs			
Dioxins/Furans	X	X	
Polychlorinated Aromatic Compounds (PAHs)	X	X	X
Pesticides		X	
Polychlorinated Biphenyls (PCBs)	X	X	X

Table 5.2
Soil Preliminary Remediation Goals

Chemicals of Potential Concern (COPCs)	Soil PRGs	Source/Receptor
Metals (mg/kg)		
Antimony	0.27	Ecological Risk Screening - Mammals
Barium	330	Ecological Risk Screening - Terrestrial Invertebrates
Cadmium	0.36	Ecological Risk Screening - Mammals
Total Chromium	1	NYSDEC Unrestricted Use Soil Criteria
Copper	28	Ecological Risk Screening - Birds
Lead	11	Ecological Risk Screening - Birds
Manganese	220	Ecological Risk Screening - Plants
Mercury	0.1	EPA Region 5 Ecological Soil Screening
Nickel	38	Ecological Risk Screening - Plants
Selenium	0.52	Ecological Risk Screening - Plants
Silver	4.2	Ecological Risk Screening - Birds
Vanadium	7.8	Ecological Risk Screening - Birds
Zinc	46	Ecological Risk Screening - Birds
PAHs (μg/kg)		
Benzo(a)anthracene	660	Younger Child Recreational Visitor
Benzo(a)pyrene	66	Younger Child Recreational Visitor
Benzo(b)fluoranthene	660	Younger Child Recreational Visitor
Butylbenzylphthalate	239	EPA Region 5 Ecological Soil Screening
Dibenz(a,h)anthracene	66	Younger Child Recreational Visitor
Di-n-butylphtalate	150	EPA Region 5 Ecological Soil Screening
Indeno(1,2,3-cd)pyrene	500	NYSDEC Unrestricted Use Soil Criteria
Sum of Low Molecular Weight PAHs	29000	Ecological Risk Screening - Terrestrial Invertebrates
Sum of High Molecular Weight PAHs	1100	Ecological Risk Screening - Mammals
Pesticides (μg/kg)		
DDT and Metabolites	21	Ecological Risk Screening - Mammals
Endrin	14	NYSDEC Unrestricted Use Soil Criteria
PCBs (μg/kg)		
Aroclor-1248	100	NYSDEC Unrestricted Use Soil Criteria for PCBs
Aroclor-1260	100	NYSDEC Unrestricted Use Soil Criteria for PCBs

Notes:

Determination of Soil PRGs detailed in Appendix B
PRGs - Preliminary Remediation Goals
mg/kg - milligrams per kilogram
μg/kg - micrograms per kilogram
NYSDEC - New York State Department of Environmental Conservation
PAHs - polycyclic aromatic hydrocarbons
PCBs - polychlorinated biphenyls
EPA - U.S. Environmental Protection Agency

Table 5.3
Sediment Preliminary Remediation Goals

Chemicals of Potential Concern (COPCs)	Sediment PRG	Source/Receptor
Metals (mg/kg)		
Arsenic	1.8	Adult Recreational Visitor
Cadmium	0.6	New York State Sediment Criteria - Lowest Effect Level
Total Chromium	26	New York State Sediment Criteria - Lowest Effect Level
Copper	16	New York State Sediment Criteria - Lowest Effect Level
Lead	31	New York State Sediment Criteria - Lowest Effect Level
Methylmercury	0.011	Sediment PRG for Mink (NOAEL Based)
Mercury	0.15	New York State Sediment Criteria - Lowest Effect Level
Nickel	16	New York State Sediment Criteria - Lowest Effect Level
Silver	1	New York State Sediment Criteria - Lowest Effect Level
Zinc	120	New York State Sediment Criteria - Lowest Effect Level
PAHs (μg/kg)		
3-Methylcholanthrene	15	Younger Child Recreational Visitor
Benzo(a)pyrene	66	Younger Child Recreational Visitor
Dibenzo(a,h)anthracene	66	Younger Child Recreational Visitor
Total PAHs	45190	Sediment PRG for Benthic Invertebrates
Pesticides (μg/kg)		
Dieldrin	11	Adult Recreational Visitor
PCBs (μg/kg)		
Aroclor-1254	0.8	New York State Sediment Criteria - Human Health Bioaccumulation
Aroclor-1260	0.8	New York State Sediment Criteria - Human Health Bioaccumulation
Total PCBs	0.8	New York State Sediment Criteria - Human Health Bioaccumulation
Others (μg/kg)		
Dioxins/Furans	0.029	Sediment PRG for Mink (NOAEL Based)

Notes:

Determination of Sediment PRGs detailed in Appendix B

mg/kg - milligrams per kilogram

μg/kg - micrograms per kilogram

PRG - Preliminary Remediation Goal

NOAEL - No Observed Adverse Effect Level

TSCA - Toxic Substances Control Act

PAHs - polycyclic aromatic hydrocarbons

PCBs - polychlorinated biphenyls

Table 5.4
Soil Cleanup Goals

0-2 ft below ground surface

Chemicals of Potential Concern (COPCs)	Soil Cleanup Goal	Soil Criteria
Metals (mg/kg)		
Barium	400	NYSDEC SCO for Commercial Use
Cadmium	4	NYSDEC SCO for Protection of Ecological Resources
Total Chromium	41	NYSDEC SCO for Protection of Ecological Resources
Copper	50	NYSDEC SCO for Protection of Ecological Resources
Lead	63	NYSDEC SCO for Protection of Ecological Resources
Manganese	1600	NYSDEC SCO for Protection of Ecological Resources
Mercury	0.18	NYSDEC SCO for Protection of Ecological Resources
Nickel	30	NYSDEC SCO for Protection of Ecological Resources
Selenium	3.9	NYSDEC SCO for Protection of Ecological Resources
Silver	2	NYSDEC SCO for Protection of Ecological Resources
Zinc	109	NYSDEC SCO for Protection of Ecological Resources
PAHs (μg/kg)		
Benzo(a)anthracene	5600	NYSDEC SCO for Commercial Use
Benzo(a)pyrene	1000	NYSDEC SCO for Commercial Use
Benzo(b)fluoranthene	5600	NYSDEC SCO for Commercial Use
Dibenz(a,h)anthracene	560	NYSDEC SCO for Commercial Use
Indeno(1,2,3-cd)pyrene	5600	NYSDEC SCO for Commercial Use
Pesticides (μg/kg)		
DDT and Metabolites	3.3	NYSDEC SCO for Protection of Ecological Resources
Endrin	140	NYSDEC SCO for Protection of Ecological Resources
PCBs (μg/kg)		
Aroclor-1248	1000	NYSDEC SCO for Commercial Use
Aroclor-1260	1000	NYSDEC SCO for Commercial Use

Deeper than 2 ft below ground surface

Chemicals of Potential Concern (COPCs)	Soil Cleanup Goal	Soil Criteria
Metals (mg/kg)		
Barium	400	NYSDEC SCO for Commercial Use
Cadmium	9.3	NYSDEC SCO for Commercial Use
Total Chromium	400	NYSDEC SCO for Commercial Use
Copper	270	NYSDEC SCO for Commercial Use
Lead	1000	NYSDEC SCO for Commercial Use
Manganese	10000	NYSDEC SCO for Commercial Use
Mercury	2.8	NYSDEC SCO for Commercial Use
Nickel	310	NYSDEC SCO for Commercial Use
Selenium	1500	NYSDEC SCO for Commercial Use
Silver	1500	NYSDEC SCO for Commercial Use
Zinc	10000	NYSDEC SCO for Commercial Use
PAHs (μg/kg)		
Benzo(a)anthracene	5600	NYSDEC SCO for Commercial Use
Benzo(a)pyrene	1000	NYSDEC SCO for Commercial Use
Benzo(b)fluoranthene	5600	NYSDEC SCO for Commercial Use
Dibenz(a,h)anthracene	560	NYSDEC SCO for Commercial Use
Indeno(1,2,3-cd)pyrene	5600	NYSDEC SCO for Commercial Use
Pesticides (μg/kg)		
DDT and Metabolites	47000	NYSDEC SCO for Commercial Use
Endrin	89000	NYSDEC SCO for Commercial Use
PCBs (μg/kg)		
Aroclor-1248	1000	NYSDEC SCO for Commercial Use
Aroclor-1260	1000	NYSDEC SCO for Commercial Use

Notes:
ft - feet
mg/kg - milligrams per kilogram
μg/kg - micrograms per kilogram
NYSDEC - New York State Department of Environmental Conservation
SCOs - Soil Cleanup Objectives
PAHs - polycyclic aromatic hydrocarbons
PCBs - polychlorinated biphenyls

Table 5.5

Estimated Area and Volumes for All Chemicals Above Cleanup Goals in Soil

Southern Swale Soils (Old Ley Creek)

Depth of Contamination (ft bgs)	Thickness of Contaminated Interval (ft)	Areal Extent (ft^2)	Volume of Contaminated Soil in Depth Interval (CY)
0-2	2	81,894	6,066
0-6	6	25,977	5,773
2-8	6	12,755	2,834
2-14	12	4,333	1,926

Maximum Areal Extent (ft^2) **107,871**
Total Volume (CY) **16,599**

Southern Swale Soils (Lower Ley Creek)

Depth of Contamination (ft bgs)	Thickness of Contaminated Interval (ft)	Areal Extent (ft^2)	Volume of Contaminated Soil in Depth Interval (CY)
0-0.5	0.5	50,920	943
0-2	2	157,270	11,650
0-3	1	7,648	283
2-5	3	14,462	1,607

Maximum Areal Extent (ft^2) **208,190**
Total Volume (CY) **14,483**

Northwest Soils (Lower Ley Creek)

Depth of Contamination (ft bgs)	Thickness of Contaminated Interval (ft)	Areal Extent (ft^2)	Volume of Contaminated Soil in Depth Interval (CY)
0-2	2	642,044	47,559
2-8	6	6,702	1,489

Maximum Areal Extent (ft^2) **642,044**
Total Volume (CY) **49,048**

TOTAL AREAL EXTENT OF SOILS ABOVE CLEANUP GOALS (ft^2) **958,105**

TOTAL VOLUME OF SOILS ABOVE CLEANUP GOALS (CY) **80,130**

Notes:
Cleanup Goals for Soil are shown on Table 5.4
ft - feet
bgs - below ground surface
CY - cubic yards

Table 5.6

Estimated Area and Volumes for All Chemicals Above Cleanup Goals in Sediment

Upstream Section

Depth of Contamination (ft bwsi)	Thickness of Contaminated Interval (ft)	Areal Extent (ft^2)	Volume of Contaminated Sediment (CY)
0-2	2	93,066	6,894
0-4	4	33,973	5,033
0-8	8	119,482	35,402

Total Areal Extent (ft^2) **246,521**
Total Volume (CY) **47,329**

Middle Section

Depth of Contamination (ft bwsi)	Thickness of Contaminated Interval (ft)	Areal Extent (ft^2)	Volume of Contaminated Sediment (CY)
0-2	2	119,978	8,887
0-3	3	16,959	1,884
0-5	5	65,029	12,042

Total Areal Extent (ft^2) **201,966**
Total Volume (CY) **22,814**

Downstream Section

Depth of Contamination (ft bwsi)	Thickness of Contaminated Interval (ft)	Areal Extent (ft^2)	Volume of Contaminated Sediment (CY)
0-1	1	69,697	2,581

Total Areal Extent (ft^2) **69,697**
Total Volume (CY) **2,581**

TOTAL AREAL EXTENT OF SEDIMENTS ABOVE CLEANUP GOALS (ft^2) **518,184**

TOTAL VOLUME OF SEDIMENTS ABOVE CLEANUP GOALS (CY) **72,724**

Notes:
Cleanup Goals for Sediments were based on a 1 milligram per kilogram (mg/kg) PCB concentration
ft - feet
bwsi - below the water-sediment interface
CY - cubic yards

Table 6.1
Identification and Screening of Remedial Technologies for Lower Ley Creek

General Response Action (GRA)	Remedial Technology	Variations	Effectiveness	Implementability	Costs	Overall Screening Conclusion*
No Action	None	None	Would not be effective in meeting RAOs.	Readily implementable. Not likely to be acceptable to public or regulatory agencies.	Very Low	Should be retained for comparative purposes only.
Institutional Controls	Government Controls	Includes controls imposed by federal, state, or local governments, such as restrictions on dredging, surface water usage, etc.	Potentially effective in reducing exposure to impacted media.	Readily implementable. Not likely to be acceptable to public or regulatory agencies except when more active forms of remediation cannot feasibly provide complete remediation.	Low	Retained as part of an active remediation alternative.
	Property Controls	Includes deed restrictions. Could limit shore modifications by property owners near the creek.	Potentially effective in reducing exposure to impacted media.	Readily implementable. Not likely to be acceptable to public or regulatory agencies except when more active forms of remediation cannot feasibly provide complete remediation.	Low	Retained as part of an active remediation alternative.
	Enforcement Tools	Includes actions such as administrative orders preventing dredging.	Potentially effective in reducing exposure to impacted media.	Readily implementable. Not likely to be acceptable to public or regulatory agencies except when more active forms of remediation cannot feasibly provide complete remediation.	Low	Retained as part of an active remediation alternative.
	Informational Devices	Includes activities such as health advisories on fish consumption, listing on registry of contaminated sites, and swimming bans.	Potentially effective in reducing exposure to impacted media.	Readily implementable. Not likely to be acceptable to public or regulatory agencies except when more active forms of remediation cannot feasibly provide complete remediation.	Low	Retained as part of an active remediation alternative.
Natural Recovery	Monitored Natural Recovery	Always should include a monitoring plan and contingency plan.	In appropriate systems, can be effective at reducing chemical concentrations and risks in physical and biological media. Allows ongoing short-term risks while remedy is achieved over a specified time period.	Implementable. Monitoring program and contingency plan required. Not likely to be acceptable to public or regulatory agencies except when more active forms of remediation cannot feasibly provide complete remediation.	Low	Retained.
Containment and Engineering Controls	Capping (sediments)	Engineered sediment cap with erosion controls as needed.	Effective at physical and chemical isolation of sediments to reduce potential exposure of aquatic organisms and people in appropriate system.	Implementable. Generally more easily placed in shallower areas. Caps along exposed shorelines may need aggressive erosion and stabilization controls such as armor stones. Difficult to implement on steep slopes.	High	Retained
		Engineered capping with reactive materials.	Innovative technology; may be effective for physical isolation and treatment, reducing potential exposure to aquatic organisms. Provides alternate approach to standard capping for systems where standard capping may be ineffective.	Potentially implementable, depending on results of bench and pilot studies. Design issues similar to cap alternative. May require extensive maintenance to replace reactive materials in some designs.	High	Not retained due to implementability issues.
		Thin-layer capping	Potentially effective in some systems. May not involve complete isolation, so effectiveness can be less than standard capping.	Implementable. Thin layers can be placed by a variety of methods. Shoreline/slope design issues similar to standard capping.	Moderate	Not retained due to effectiveness issues.

Table 6.1 (continued)
Identification and Screening of Remedial Technologies for Lower Ley Creek

General Response Action (GRA)	Remedial Technology	Variations	Effectiveness	Implementability	Costs	Overall Screening Conclusion*
	Capping (soils)	Thin-layer capping	Potentially effective in some systems. May not involve complete isolation, so effectiveness can be less than standard capping.	Implementable. Thin layers can be placed by a variety of methods.	Moderate	Retained
	Vertical Barrier Containment	Deep soil mixing	Effective as a hydraulic barrier to reduce contaminant flux to creek. Potential short-term impacts due to resuspension of contaminants.	Implementable in near shore, difficult in deeper waters. Less prone to corrosion and may have more strength than sheetpiling.	High	Not retained due to implementability issues.
		Slurry Wall	Effective as a hydraulic barrier to reduce contaminant flux to creek. Potential short-term impacts due to resuspension of contaminants.	Potentially implementable depending on water depth, wall depth, and soil being displaced.	Moderate	Not retained due to implementability issues.
		Sheetpiling	Effective as a hydraulic barrier to reduce contaminant flux to creek.	Potentially implementable near shore, although quality control may be difficult when installed through water and depth may be an issue.	Moderate	Not retained due to implementability issues.
Sediment Removal (includes potential best management practices [BMPs], transport, and dewatering)	Dredging	Mechanical Dredging	Effective at removing risks related to chemicals from environment of concern. Elevated short-term risks from resuspensed sediments likely in highly contaminated sediments. Potential long-term impacts from residual sediment-related chemicals lost to wider areas.	Implementable, particularly in shallower areas. May require implementation of BMPs that can slow production. Rehandling and dewatering steps required in most cases. May need backfill or additional dredging for slope stability.	High	Retained
		Hydraulic Dredging	Effective at removing risks related to chemicals from environment of concern. Elevated short-term risks from resuspensed sediments (but often less than mechanical) and entrained water likely in highly contaminated sediments. Potential long-term impacts from residual sediment-related chemicals lost to wider areas. Potential impacts from discharge water.	Implementable, particularly in shallower areas. May require implementation of BMPs that can slow production. May need backfill or additional dredging for slope stability. May require specialized equipment. Water separation and water treatment would be required. Land requirements are high for entrained water and solids handling.	High	Retained
		Combination/ Hybrid Mechanical/ Hydraulic Dredging	Effective at removing risks related to chemicals from environment of concern. Elevated short-term risks from resuspensed sediments (often more so for mechanical) and entrained water likely in highly contaminated sediments. Potential long-term impacts from residual sediment-related chemicals lost to wider areas. Potential impacts from discharge water.	Implementable, particularly in shallower areas. May require implementation of BMPs that can slow production. May need backfill or additional dredging for slope stability. May require specialized equipment. Water separation and water treatment would be required. Land requirements are high for entrained water and solids handling.	High	Retained

Table 6.1 (continued)
Identification and Screening of Remedial Technologies for Lower Ley Creek

General Response Action (GRA)	Remedial Technology	Variations	Effectiveness	Implementability	Costs	Overall Screening Conclusion*
		Pneumatic Dredging	Effective at removing risks related to chemicals from environment of concern. Elevated short-term risks from resuspensed sediments (but often less than mechanical) and entrained water likely in highly contaminated sediments. Potential long-term impacts from residual sediment-related chemicals lost to wider areas. Potential impacts from discharge water less due to higher slurry concentration.	Difficult implementability. Equipment not available on a commercial scale. Only feasible in soft, fine-grained material. Not feasible in water depths less than 7 ft deep.	Very High	Not retained due to implementability issues.
	Dry Excavation	Mechanical Excavation	Effective at removing risks related to chemicals from environment of concern. Fewer short-term chemical impacts than dredging.	Implementable in shallow (<12 ft water depth) near shore areas. Requires water diversion structures. Rehandling and dewatering steps required.	Moderate	Retained.
Soil Removal	Excavation	Mechanical Excavation	Effective at removing risks related to chemicals from environment of concern	Implementable at stable, near shore locations.	Moderate	Retained.
Disposal (sediment and soil)	On-Site Consolidation	Solid waste or SDA	Can be effective with proper design and construction, including liners, caps, and leachate control. Potential short-term impacts with rehandling steps.	Implementable. Design approaches proven. Potentially suitable areas exist near site. Regulatory and community acceptance status needs to be finalized with NYSDEC. Requires extensive long-term maintenance.	Moderate	Retained.
	Off-Site Disposal	Solid waste or hazardous waste landfill, including Canada.	Can be effective when taken to a properly designed existing landfill. Potential short-term impacts with rehandling/transport steps.	Implementable. Suitably permitted landfills exist. Requires transport of at least 8 to 170 miles. Requires extensive long-term maintenance.	Moderate	Retained
	Water Management/ Treatment		Potential impacts from discharge water with and without treatment.	Implementable. Proven technologies exist.	Moderate	Retained
	Beneficial Reuse (after ex situ treatment)		Effective only with fully treated soils and sediments.	Implementable where treatment is sufficient.	Moderate	Not retained. Dependent on treatment technologies that were not retained (see below).
In Situ Treatment	Chemical/Biological		Innovative technology potentially effective for reducing mobility or toxicity of contaminants in soils, sediments and surface water.	Limited implementability. Technology not widely proven on a large scale.	High	Not retained. Too many implementation issues as compared to more proven technologies.
	Phytoremediation		Innovative technology potentially effective degrading and removing organics and removing inorganics.	Limited implementability. Technology not proven on a field scale. Difficult or impossible to implement on large amounts of soils and sediments. May requires maintenance through harvest and removal of plants.	High	Not retained. Too many implementation issues as compared to more proven technologies.
	Solidification/ stabilization		Innovative technology potentially effective at immobilizing and stabilizing heavy metals in a non-leachable matrix. Most effective for ponds, rivers or industrial lagoons where the treatment area can be isolated.	Applications to date identified significant issues associated with implementation. Inability to control mixing conditions and curing temperature has resulted in no successful applications. Significant sediment resuspension would likely occur.	High	Not retained. Too many implementation issues as compared to more proven technologies.

Table 6.1 (continued)
Identification and Screening of Remedial Technologies for Lower Ley Creek

General Response Action (GRA)	Remedial Technology	Variations	Effectiveness	Implementability	Costs	Overall Screening Conclusion*
Ex Situ Treatment	Thermal Desorption (including thermal retort)		Effective for removal/volatilization of organic constituents and mercury. Not effective for removal of most inorganic compounds, but it has been used to remove mercury. Potential short-term impacts with rehandling steps.	Implementable for some chemicals, but mercury vapor control is complex. USEPA recommends against thermal treatment of mercury due to difficulties in controlling off gas. Requires numerous rehandling steps.	High	Not retained. Numerous handling and logistical steps. Limited chemical applicability.
	Incineration/ Vitrification		Effective for destruction and/or removal of organic constituents. Not effective for destruction of inorganic compounds. Potential short-term impacts with rehandling steps.	Potentially implementable. On-site incineration typically meets significant public resistance. Control of mercury vapors is a severe problem.	High	Not retained. Numerous handling and logistical steps. Limited chemical applicability.
	Dechlorination		Potentially effective in detoxifying specific types of aromatic organics, in particular dioxins and PCBs. Not effective for the heavy metal COCs. Potential short-term impacts with rehandling steps.	Very difficult to implement due to excessive amounts of reagent required for chlorinated compounds, lack of full-scale applications to date, and lack of commercial availability. Past applications have been in conjunction with thermal treatment.	High	Not retained. Numerous implementation issues and limited chemical applicability.
	Chemical Extraction		Potentially effective for extracting organics and metals, including chlorobenzenes and mercury. The extraction solution is then treated to remove and recover contaminants. Potential short-term impacts from chemicals and rehandling steps.	Can be difficult to implement due to complex treatment requirements for extraction fluid, lack of full-scale applications to date, and lack of commercial availability.	High	Not retained. Numerous implementation issues and limited chemical applicability.
	Sediment/Soil Washing		Potentially effective physical separation process for removing organics and metals through separation of fine fraction, where this fraction contains the majority of the contamination. Potential short-term impacts from rehandling steps.	Very difficult to implement due to complex treatment requirements for extraction fluid, lack of full-scale applications to date, and lack of commercial availability.	High	Not retained. Numerous implementation issues.
	Solidification/ Stabilization		Effective for improving material handling and for immobilizing and stabilizing heavy metals in a non-leachable matrix. Stabilizing mercury in soils and sediments, for example, has been tested based on sulfide precipitation. Potential short-term impacts from rehandling steps.	Difficult to implement. Addition of solidifying or stabilizing reagents may increase both volume and weight for disposal or containment.	High	Not retained. Too many implementation issues as compared to more proven technologies.
	Biological (includes land farming and slurry phase bioremediation)		Effective at biodegradation of simple organic chemicals. Not effective with transformation of mercury. May release large volumes of volatile chemicals. Potential short-term impacts from rehandling steps.	Difficult to implement on large scale.	High	Not retained. Too many implementation issues as compared to more proven technologies.

Notes:
Highlighted cells indicate remedial technologies that were not retained.
* The overall screening conclusion considers whether the remedial technology should be "retained" for use in developing remedial alternatives in Section 7 (the next step of the evaluation process) or "not retained" for further evaluation.

Table 7.1
Lower Ley Creek Soil Remedial Alternatives

Description	Alternative Soil-1 No Action	Alternative Soil-2 Excavation of Soil to Meet Cleanup Goals	Alternative Soil-3 Excavation of Southern Swale Soils to Meet Cleanup Goals and Soil Cap for Northwest Soils	Alternative Soil-4 Soil Cap Over All Soils Exceeding Cleanup Goals
Southern Swale Soils (Includes Old Ley Creek Area)	No Action	Excavate contaminated areas to meet cleanup goals and backfill near grade. Limited wetlands restoration.	Excavate contaminated areas to meet cleanup goals and backfill near grade. Limited wetlands restoration.	Soil Cap Over Areas Exceeding Cleanup Goals in Soil[1]
Northwest Soils	No Action	Excavation of contaminated areas to meet cleanup goals outside of pipeline areas and soil cap over remaining contaminated areas.	Soil Cap Over Areas Exceeding Cleanup Goals in Soil[1]	Soil Cap Over Areas Exceeding Cleanup Goals in Soil[1]

Notes:

[1] Soil caps will be approximately 1 ft thick and include a demarcation layer between the contaminated soil and the soil cap.

Table 7.2
Development and Initial Screening of Soil Remedial Alternatives

Alternative	Description	Effectiveness	Implement	Relative Cost	Comments
Soil 1 - No Action	No soil areas would be remediated.	Not effective in addressing risks.	Implementable	Low	Retained for comparison purposes
Soil 2 - Excavation of Soil to Meet Cleanup Goals	Southern Swale Soils: Excavate contaminated areas to meet the cleanup goal and backfill near grade. Limited wetlands restoration. Northwest Soils: Excavation of contaminated areas to meet cleanup goals outside of pipeline areas and soil cap over remaining contaminated areas.	Potentially effective for addressing chemicals of potential concern (COPCs) exceeding risks in soil.	Implementable	High	Retained
Soil 3 - Excavation of Southern Swale Soils to Meet Cleanup Goals and Soil Cap for Northwest Soils	Southern Swale Soils: Excavate contaminated areas to meet the cleanup goal and backfill near grade. Limited wetlands restoration. Northwest Soils: Soil Cap Over Areas Exceeding Restricted Use Cleanup Goals for Soil.	Potentially effective for addressing COPCs exceeding risks in soil.	Implementable	Medium - High	Retained
Soil 4 - Soil Cap over All Soils Exceeding Cleanup Goals	Southern Swale Soils: Soil Cap Over Areas Exceeding Cleanup Goals for Soil. Northwest Soils: Soil Cap Over Areas Exceeding Cleanup Goals for Soil.	Potentially effective for addressing COPCs exceeding risks in soil.	Implementable	Medium	Retained

Notes:
Soil caps will be approximately 1 ft thick and include a demarcation layer between the contaminated soil and the soil cap.

Table 7.3
Soil Alternative 2 Excavation and Capping Calculations

Southern Swale Soils (Old Ley Creek) - Excavation

Depth of Contamination (ft bgs)	Thickness of Contaminated Interval (ft)	Areal Extent (ft^2)	Volume of Contaminated Soil in Depth Interval (CY)
0-2	2	81,894	6,066
0-6	6	25,977	5,773
2-8	6	12,755	2,834
2-14	12	4,333	1,926

Total Volume (CY)	**16,599**
Total Aerial Extent of Excavation (ft^2)	**107,871**

Southern Swale Soils (Lower Ley Creek) - Excavation

Depth of Contamination (ft bgs)	Thickness of Contaminated Interval (ft)	Areal Extent (ft^2)	Volume of Contaminated Soil in Depth Interval (CY)
0-0.5	0.5	50,920	943
0-2	2	157,270	11,650
2-3	1	7,648	283
2-5	3	14,462	1,607

Total Volume (CY)	**14,483**
Total Aerial Extent of Excavation (ft^2)	**208,190**

Northwest Soils - Excavation and Capping

Depth of Contamination (ft bgs)	Thickness of Contaminated Interval (ft)	Areal Extent (ft^2)	Volume of Contaminated Soil in Depth Interval (CY)
0-2	2	576,010	42,667
2-8	6	6,702	1,489

Total Volume (CY)	**44,157**
Total Aerial Extent of Excavation (ft^2)	**509,976**
Areal Extent of Area over Pipelines (ft^2)	**66,034**
TOTAL AREAL EXTENT OF SOIL TO BE CAPPED (ft^2)	**66,034**
TOTAL VOLUME OF SOIL TO BE EXCAVATED (CY)	**75,239**
TOTAL AREAL EXTENT OF HABITAT RESTORATION (ft^2)	**892,071**
TOTAL VOLUME OF BACKFILL/HABITAT RESTORATION MATERIAL (CY)	**75,239**

Notes:

Areal Extents are shown on Figure 7.1 and Figure 7.2

ft - feet

bgs - below ground surface

CY - cubic yards

Table 7.4
Soil Alternative 3 Excavation and Capping Calculations

Southern Swale Soils (Old Ley Creek) - Excavation

Depth of Contamination (ft bgs)	Thickness of Contaminated Interval (ft)	Areal Extent (ft^2)	Volume of Contaminated Soil in Depth Interval (CY)
0-2	2	81,894	6,066
0-6	6	25,977	5,773
2-8	6	12,755	2,834
2-14	12	4,333	1,926
		Total Volume (CY)	**16,599**
		Total Aerial Extent of Excavation (ft^2)	**107,871**

Southern Swale Soils (Lower Ley Creek) - Excavation

Depth of Contamination (ft bgs)	Thickness of Contaminated Interval (ft)	Areal Extent (ft^2)	Volume of Contaminated Soil in Depth Interval (CY)
0-0.5	0.5	50,920	943
0-2	2	157,270	11,650
2-3	1	7,648	283
2-5	3	14,462	1,607
		Total Volume (CY)	**14,483**
		Total Aerial Extent of Excavation (ft^2)	**208,190**

Northwest Soils - Excavation and Capping

Depth of Excavation for Cap Placement and Habitat Restoration (ft bgs)	Excavation Thickness (ft)	Areal Extent (ft^2)	Volume of Excavated Contaminated Soil (CY)
0-2	2	576,010	42,667
Capping over deeper contamination	1	6,702	248
Capping over Pipeline	0	66,034	0
		Total Volume of Excavation (CY)	**42,916**
		Total Aerial Extent of Excavation (ft^2)	**576,010**
		Areal Extent of Soil Cap Area (ft^2)	**72,736**

TOTAL AREAL EXTENT OF SOIL TO BE CAPPED (ft^2)	**72,736**
TOTAL VOLUME OF SOIL TO BE EXCAVATED (CY)	**73,997**
TOTAL AREAL EXTENT OF HABITAT RESTORATION (ft^2)	**892,071**
TOTAL VOLUME OF BACKFILL/HABITAT RESTORATION MATERIAL (CY)	**73,749**

Notes:

Areal Extents are shown on Figure 7.1 and Figure 7.3

ft - feet

bgs - below ground surface

CY - cubic yards

Table 7.5
Soil Alternative 4 Excavation and Capping Calculations

Southern Swale Soils (Old Ley Creek) - Excavation and Capping

Depth of Excavation for Cap Placement and Habitat Restoration (ft bgs)	Excavation Thickness (ft)	Areal Extent (ft^2)	Volume of Excavated Contaminated Soil (CY)
0-2	2	81,894	6,066
Capping over deeper contamination	1	39,731	1,472
		Total Volume of Excavation (CY)	**7,538**
		Total Aerial Extent of Excavation (ft^2)	**107,871**
		Areal Extent of Soil Cap Area (ft^2)	**39,731**

Southern Swale Soils (Lower Ley Creek) - Excavation and Capping

Depth of Excavation for Cap Placement and Habitat Restoration (ft bgs)	Excavation Thickness (ft)	Areal Extent (ft^2)	Volume of Excavated Contaminated Soil (CY)
0-0.5	0.5	50,920	943
0-2	2	157,270	11,650
Capping over deeper contamination	1	22,109	819
		Total Volume of Excavation (CY)	**13,411**
		Total Aerial Extent of Excavation (ft^2)	**208,190**
		Areal Extent of Soil Cap Area (ft^2)	**22,109**

Northwest Soils - Excavation and Capping

Depth of Excavation for Cap Placement and Habitat Restoration (ft bgs)	Excavation Thickness (ft)	Areal Extent (ft^2)	Volume of Excavated Contaminated Soil (CY)
0-2	2	576,010	42,667
Capping over deeper contamination	1	6,702	248
Capping over Pipeline	0	66,034	0
		Total Volume of Excavation (CY)	**42,916**
		Total Aerial Extent of Excavation (ft^2)	**576,010**
		Areal Extent of Soil Cap Area (ft^2)	**72,736**

TOTAL AREAL EXTENT OF SOIL TO BE CAPPED (ft^2)	**134,576**
TOTAL VOLUME OF SOIL TO BE EXCAVATED (CY)	**63,865**
TOTAL AREAL EXTENT OF HABITAT RESTORATION (ft^2)	**892,071**
TOTAL VOLUME OF BACKFILL/HABITAT RESTORATION MATERIAL (CY)	**61,326**

Notes:

Areal Extents are shown on Figure 7.3 and Figure 7.4

ft - feet

bgs - below ground surface

CY - cubic yards

Table 7.6
Lower Ley Creek Sediment Remedial Alternatives

Description	Alternative Sediment-1 No Action	Alternative Sediment-2 Removal of Sediment to Cleanup Goals	Alternative Sediment-3 Granular Material Sediment Cap	Alternative Sediment-4 Engineered Bentonite Sediment Cap	Alternative Sediment-5 Monitored Natural Recovery
Upstream Sediments (Includes Old Ley Creek Channel)	No Action	Removal of Sediment to Cleanup Goals	Excavate and backfill with granular/armor capping material design[1]	Excavate and backfill with engineereed clay aggregate capping material design[1]	Monitored Natural Recovery
Middle Sediments	No Action	Removal of Sediment to Cleanup Goals	Excavate and backfill with granular/armor capping material design[1]	Excavate and backfill with engineereed clay aggregate capping material design[1]	Monitored Natural Recovery
Downstream Sediments	No Action	Excavate Hot Spots	Excavate Hot Spots	Excavate Hot Spots	Monitored Natural Recovery

Notes:

[1] These are approximate depths that will be based on the thickness of capping material design required to isolate the contaminated sediments, provide a suitable habitat for biota, and maintain the current bathymetry of Lower Ley Creek.

All capping alternatives will consider the Conceptual Site Model of the creek.

ft - feet

Table 7.7
Development and Initial Screening of Sediment Remedial Alternatives

Alternative	Description	Effectiveness	Implement	Relative Cost	Comments
Sediment 1 - No Action	No action would be taken on the sediment contamination.	Not effective in addressing risks.	Implementable	Low	Retained for comparison purposes
Sediment 2 - Removal of All Sediments to Cleanup Goals	Upstream Sediments: Removal of contaminated sediments. Middle Sediments: Removal of contaminated sediments. Downstream Sediments: Removal of contaminated sediments.	Potentially effective for addressing chemicals of potential concern (COPCs) exceeding risks in sediment.	Implementable	High	Retained
Sediment 3 - Granular Material Sediment Cap	Upstream Sediments: Excavate and backfill with granular/armor capping material design and habitat layer. Middle Sediments: Excavate and backfill with granular/armor capping material design and habitat layer. Downstream Sediments: Removal of contaminated sediments.	Potentially effective for addressing COPCs exceeding risks in sediment. Detailed evaluation required to determine effectiveness of engineered sediment cap.	Implementable	Medium - High	Retained
Sediment 4 - Engineered Bentonite Sediment Cap	Upstream Sediments: Excavate and backfill with an engineered bentonite material design and habitat layer. Middle Sediments: Excavate and backfill with an engineered bentonite material design and habitat layer. Downstream Sediments: Removal of contaminated sediments.	Potentially effective for addressing COPCs exceeding risks in sediment. Detailed evaluation required to determine effectiveness of engineered sediment cap.	Implementable	Medium - High	Retained
Sediment 5 - Monitored Natural Recovery	No active remediation would be undertaken at the Site. Natural recovery processes would be relied upon to further reduce risk in the Lower Ley Creek over time. A 30-year monitoring program would be developed and implemented.	Can be effective at reducing chemical concentrations and risks in physical and biological media. Allows ongoing short-term risks while remedy is achieved over a specified time period.	Implementable	Low-Medium	Retained

Notes:

All sediment capping of the hot spots will be completed in a manner that maintains the current bathymetry of Lower Ley Creek.

Depths of excavation for capping alternatives will be based on the thickness of capping material design required to isolate the contaminated sediments, provide a suitable habitat for biota, and maintain the current bathymetry of Lower Ley Creek.

All capping alternatives will consider the Conceptual Site Model of the creek.

ft - feet

Table 7.8
Sediment Alternative 2 Excavation Calculations

Upstream Section - Excavation

Depth of Contamination (ft bwsi)	Thickness of Contaminated Interval (ft)	Areal Extent (ft^2)	Volume of Contaminated Sediment (CY)
0-2	2	93,066	6,894
0-4	4	33,973	5,033
0-8	8	119,482	35,402

Total Areal Extent (ft^2)	**246,521**
Total Volume (CY)	**47,329**

Middle Section - Excavation

Depth of Contamination (ft bwsi)	Thickness of Contaminated Interval (ft)	Areal Extent (ft^2)	Volume of Contaminated Sediment (CY)
0-2	2	119,978	8,887
0-3	3	16,959	1,884
0-5	5	65,029	12,042

Total Areal Extent (ft^2)	**201,966**
Total Volume (CY)	**22,814**

Downstream Section - Excavation

Depth of Contamination (ft bwsi)	Thickness of Contaminated Interval (ft)	Areal Extent (ft^2)	Volume of Contaminated Sediment (CY)
0-1	1	69,697	2,581

Total Areal Extent (ft^2)	**69,697**
Total Volume (CY)	**2,581**

TOTAL AREAL EXTENT OF SEDIMENTS TO BE CAPPED (ft^2)	**-**
TOTAL VOLUME OF BACKFILL SEDIMENT (CY)	**19,192**
TOTAL VOLUME OF SEDIMENTS TO BE EXCAVATED (CY)	**72,724**

Notes:
Areal Extents are shown on Figure 7.5, Figure 7.6, and Figure 7.7
ft - feet
bwsi - below the water-sediment interface
CY - cubic yards

Table 7.9
Sediment Alternative 3 Excavation and Capping Calculations

Upstream Section - Excavation and Capping

Depth of Excavation Required to Maintain Bathmetry of creek (ft bwsi)	Excavation Thickness (ft)	Areal Extent (ft^2)	Volume of Excavated Sediment (CY)
0-2	2	32,111	2,379
0-4	4	33,973	5,033
Capping over deeper contamination	6	119,482	26,552

Total Areal Extent of Sand Cap/Isolation Layer (ft^2)	**119,482**
Total Areal Extent of Armor Cap (ft^2)	**119,482**
Total Volume of Sand Cap/Isolation Layer (CY)	**8,851**
Total Volume of Armor Cap (CY)	**8,851**
Total Volume of Excavated Sediment (CY)	**33,963**

Middle Section - Excavation and Capping

Depth of Excavation Required to Maintain Bathmetry of creek (ft bwsi)	Excavation Thickness (ft)	Areal Extent (ft^2)	Volume of Excavated Sediment (CY)
0-2	2	119,978	8,887
0-3	3	16,959	1,884
Capping over deeper contamination	3.875	65,029	9,333

Total Volume of Sand Cap/Isolation Layer (CY)	**3,613**
Total Areal Extent of Armor Cap (ft^2)	**65,029**
Total Volume of Armor Cap (CY)	**903**
Total Volume of Excavated Sediment (CY)	**20,104**

Downstream Section - Excavation

Depth of Excavation (ft bwsi)	Excavation Thickness (ft)	Areal Extent (ft^2)	Volume of Excavated Sediment (CY)
0-1	1	69,697	2,581

Total Areal Extent of Sand Cap (ft^2)	**-**
Total Volume of Sand Cap (CY)	**-**
Total Volume of Excavated Sediment (CY)	**2,581**
TOTAL VOLUME OF SAND CAP (CY)	**12,463**
TOTAL VOLUME OF Upstream Section (2 ft thick) ARMOR CAP (ft^2)	**8,851**
TOTAL VOLUME OF Middle Section (0.375 ft thick) ARMOR CAP (ft^2)	**903**
TOTAL VOLUME OF 2 ft thick HABITAT LAYER (CY)	**33,869**
TOTAL VOLUME OF BACKFILL SEDIMENTS in Downstream Section (CY)	**2,581**
TOTAL VOLUME OF SEDIMENTS TO BE EXCAVATED (CY)	**56,649**

Notes:

Areal Extents are shown on Figure 7.7, Figure 7.8, and Figure 7.9

ft - feet

bwsi - below the water-sediment interface

CY - cubic yards

Table 7.10
Sediment Alternative 4 Excavation and Capping Calculations

Upstream Section - Capping

Depth of Excavation Required to Maintain Bathmetry of creek (ft bwsi)	Excavation Thickness (ft)	Areal Extent (ft^2)	Volume of Excavated Sediment (CY)
0-2.25	2.25	240,397	20,033

Total Areal Extent of Bentonite Cap (ft^2)	**240,397**
Total Volume of Excavated Sediment (CY)	**20,033**

Middle Section - Capping

Depth of Excavation Required to Maintain Bathmetry of creek (ft bwsi)	Excavation Thickness (ft)	Areal Extent (ft^2)	Volume of Excavated Sediment (CY)
0-2.25	2.25	203,559	16,963

Total Areal Extent of Bentonite Cap (ft^2)	**203,559**
Total Volume of Excavated Sediment (CY)	**16,963**

Downstream Section - Excavation

Depth of Excavation (ft bwsi)	Excavation Thickness (ft)	Areal Extent (ft^2)	Volume of Excavated Sediment (CY)
0-1	1	69,697	2,581

Total Areal Extent of Bentonite Cap (ft^2)	**-**
Total Volume of Excavated Sediment (CY)	**2,581**

TOTAL AREAL EXTENT OF SEDIMENTS TO BE CAPPED (ft^2)	**443,956**
TOTAL VOLUME OF HABITAT LAYER (2 ft thick) (CY)	**32,886**
TOTAL VOLUME OF BACKFILL SEDIMENTS in Downstream Section (CY)	**2,581**
TOTAL VOLUME OF SEDIMENTS TO BE EXCAVATED (CY)	**39,578**

Notes:

Areal Extents are shwon on Figure 7.7, Figure 7.10, and Figure 7.11
ft - feet
bwsi - below the water-sediment interface
CY - cubic yards

Table 8.1
Detailed Evaluation of Soil Remedial Alternatives for Lower Ley Creek

Evaluation Criteria	Soil Alternative 1 No Action	Soil Alternative 2 Excavation of Soil to Meet Cleanup Goals	Soil Alternative 3 Excavation of Southern Swale Soils to Meet Cleanup Goals and Soil Cap for Northwest Soils	Soil Alternative 4 Soil Cap Over All Contaminated Soils
Overall Protection of Human Health and the Environment	The No Action alternative would not be protective of human health and the environment, because this would not actively address the contaminated soils that present unacceptable risks of exposure to receptors or the release and transport of COPCs at the site. The RAOs or PRGs would not be met under this alternative.	• Excavation of contaminated soils would provide protection of human health and the environment by eliminating the exposure pathways associated with impacted soils. Removal would also eliminate future potential COPC releases to the creek. • Capping contaminated soils would provide overall protection of human health and the environment by eliminating the potential human health and ecological exposure pathways associated with impacted soils. Clean cap material would prevent direct exposure of humans and ecological receptors to contaminated soil. Erosion control measures on the cap would reduce or eliminate the potential COPC releases to the creek.	• Excavation of contaminated soils would provide protection of human health and the environment by eliminating the exposure pathways associated with impacted soils. Removal would also eliminate future potential COPC releases to the creek. • Capping contaminated soils would provide overall protection of human health and the environment by eliminating the potential human health and ecological exposure pathways associated with impacted soils. Clean cap material would prevent direct exposure of humans and ecological receptors to contaminated soil. Erosion control measures on the cap would reduce or eliminate the potential COPC releases to the creek.	• Capping contaminated soils would provide overall protection of human health and the environment by eliminating the potential human health and ecological exposure pathways associated with impacted soils. Clean cap material would prevent direct exposure of humans and ecological receptors to contaminated soil. Erosion control measures on the cap would reduce or eliminate the potential COPC releases to the creek.
Compliance with ARARs	There are chemical-specific ARARs for soils. The No Action alternative would not meet these ARARs.	• This alternative would comply with chemical-specific, location-specific and action-specific ARARs. • Soil caps are routinely installed in compliance with ARARs.	• This alternative would comply with chemical-specific, location-specific and action-specific ARARs. • Soil caps are routinely installed in compliance with ARARs.	• This alternative would comply with chemical-specific, location-specific and action-specific ARARs. • Soil caps are routinely installed in compliance with ARARs.
Long-Term Effectiveness and Permanence	This alternative does not provide significant long-term effectiveness. This alternative would not effectively eliminate the potential exposure to contaminants in soil. The rate of improvement is unpredictable and would not be verified due to the lack of monitoring under this alternative.	• This alternative would provide long-term effectiveness and permanence by eliminating the potential human health and ecological exposure pathways associated with impacted soil. • A site management plan would be implemented to confirm that the soil cap remains effective over time.	• This alternative would provide long-term effectiveness and permanence by eliminating the potential human health and ecological exposure pathways associated with impacted soil. • A site management plan would be implemented to confirm that the soil cap remains effective over time.	• This alternative would provide long-term effectiveness and permanence by eliminating the potential human health and ecological exposure pathways associated with impacted soil. • A site management plan would be implemented to confirm that the soil cap remains effective over time.
Reduction of Toxicity, Mobility, or Volume through Treatment	The toxicity and volume of COPCs in soil would not be significantly reduced under the No Action alternative because no treatment would be conducted. The overall bioavailability and mobility of contaminants in the soil may be reduced over time as some natural recovery processes occur.	• Removal of contaminated soils would result in reducing the toxicity, mobility, and volume of the soil. The greater the volume of soil removed, the greater the reduction in toxicity, mobility and volume of COPCs. • Capping relies on isolation rather than treatment to achieve effectiveness. Natural processes that reduce toxicity such as biological degradation of organic compounds would continue to occur beneath the soil cap following construction, although these processes may be insignificant.	• Removal of contaminated soils would result in reducing the toxicity, mobility, and volume of the soil. The greater the volume of soil removed, the greater the reduction in toxicity, mobility and volume of COPCs. • Capping relies on isolation rather than treatment to achieve effectiveness. Natural processes that reduce toxicity such as biological degradation of organic compounds would continue to occur beneath the soil cap following construction, although these processes may be insignificant.	• Capping relies on isolation rather than treatment to achieve effectiveness. Natural processes that reduce toxicity such as biological degradation of organic compounds would continue to occur beneath the soil cap following construction, although these processes may be insignificant.

Table 8.1 (continued)
Detailed Evaluation of Soil Remedial Alternatives for Lower Ley Creek

Evaluation Criteria	Soil Alternative 1 No Action	Soil Alternative 2 Excavation of Soil to Meet Cleanup Goals	Soil Alternative 3 Excavation of Southern Swale Soils to Meet Cleanup Goals and Soil Cap for Northwest Soils	Soil Alternative 4 Soil Cap Over All Contaminated Soils
Short-Term Effectiveness	The No Action alternative does not include any physical construction measures in any areas of contamination and, therefore, would not present any potential adverse impacts to the community or workers as a result of its implementation.	• Physical construction of this alternative could likely be completed in approximately one construction season. The effects of this alternative during the construction and implementation phase would potentially include: ○ Impact to local property owners during soil removals and capping; ○ Impact to local pipelines during soil removals and capping; ○ Additional potential risk presented by volatilization of organics during excavation and materials handling; ○ Potential for on-site worker and transportation accidents associated with remedial construction; and ○ Potential for on-site workers to receive adverse impacts through dermal contact with contaminated soil. • Excavation and contaminated media handling may create air emissions and odors through release of SVOCs and VOCs from the removed materials. However, significant odors and air emissions are not expected. This short-term impact may be minimized or mitigated through engineering controls including controlled excavation, wearing proper PPE, and adequate monitoring.	• Physical construction of this alternative could likely be completed in approximately one construction season. The effects of this alternative during the construction and implementation phase would potentially include: ○ Impact to local property owners during soil removals and capping; ○ Impact to local pipelines during soil removals and capping; ○ Additional potential risk presented by volatilization of organics during excavation and materials handling; ○ Potential for on-site worker and transportation accidents associated with remedial construction; and ○ Potential for on-site workers to receive adverse impacts through dermal contact with contaminated soil. • Excavation and contaminated media handling may create air emissions and odors through release of SVOCs and VOCs from the removed materials. However, significant odors and air emissions are not expected. This short-term impact may be minimized or mitigated through engineering controls including controlled excavation, wearing proper PPE, and adequate monitoring.	• Physical construction of this alternative could likely be completed in approximately one construction season. The effects of this alternative during the construction and implementation phase would potentially include: ○ Impact to local property owners during soil removals and capping; ○ Impact to local pipelines during soil removals and capping; ○ Additional potential risk presented by volatilization of organics during excavation and materials handling; ○ Potential for on-site worker and transportation accidents associated with remedial construction; and ○ Potential for on-site workers to receive adverse impacts through dermal contact with contaminated soil. • Based on experience at other soil capping sites, the impacts are not anticipated to be significant. Proven, available engineering controls would be employed during the soil cap implementation. In addition, steps would be taken to minimize the impact to local property owners during the soil capping process.

Table 8.1 (continued)
Detailed Evaluation of Soil Remedial Alternatives for Lower Ley Creek

Evaluation Criteria	Soil Alternative 1 No Action	Soil Alternative 2 Excavation of Soil to Meet Cleanup Goals	Soil Alternative 3 Excavation of Southern Swale Soils to Meet Cleanup Goals and Soil Cap for Northwest Soils	Soil Alternative 4 Soil Cap Over All Contaminated Soils
Implementability	The No Action alternative would be easy to implement as there are no activities to undertake.	• Appropriate soil excavation and capping technologies are readily available and implementable, and construction procedures are well established. Excavation and capping have been demonstrated as effective remedial technologies for impacted soils at numerous sites. The technology, equipment, subcontractors, personnel, and facilities required to successfully excavate or cap contaminated soils are available in the environmental market place. Guidance documents are also available from numerous sources, including the USEPA and the USACE, on how to successfully design, construct, and monitor soil cap projects. • Short-term and long-term monitoring as part of a site management plan can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken should the alternative prove to be ineffective or partially ineffective although greater removal volumes would require either longer durations or additional dredging and excavation equipment. • The presence of two large buried pipelines in the Northwest Soils area may limit the removal of contaminated soils in that vicinity. Therefore, in those areas, a soil cap will be installed above contaminated soil..	• Appropriate soil excavation and capping technologies are readily available and implementable, and construction procedures are well established. Excavation and capping have been demonstrated as effective remedial technologies for impacted soils at numerous sites. The technology, equipment, subcontractors, personnel, and facilities required to successfully excavate or cap contaminated soils are available in the environmental market place. Guidance documents are also available from numerous sources, including the USEPA and the USACE, on how to successfully design, construct, and monitor soil cap projects. • Short-term and long-term monitoring as part of a site management plan can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken should the alternative prove to be ineffective or partially ineffective although greater removal volumes would require either longer durations or additional dredging and excavation equipment.	• Appropriate soil capping technologies are readily available and implementable, and construction procedures are well established. Soil capping has been demonstrated as an effective remedial technology for impacted soils at numerous sites. The technology, equipment, subcontractors, personnel, and facilities required to successfully excavate or cap contaminated soils are available in the environmental market place. Guidance documents are also available from numerous sources, including the USEPA and the USACE, on how to successfully design, construct, and monitor soil cap projects. • Short-term and long-term monitoring as part of a site management plan can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken should the alternative prove to be ineffective.
Cost (On-site Disposal)[1]	$ 49,636	$ 9,968,720	$ 9,868,369	$ 8,643,373
Cost (Off-site Disposal)[1]	$ 49,636	$ 18,430,403	$ 18,190,372	$ 15,825,890
State Acceptance	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated
Community Acceptance	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated

Notes:
[1] Cost calculations for each alternative are presented in Appendix C
COPC – chemical of potential concern
RAO – remedial action objective
PRG – preliminary remediation goal
ARAR – applicable or relevant and appropriate requirement
CWA – Clean Water Act
EPA – U.S. Environmental Protection Agency
SVOC – semi-volatile organic compound
VOC – volatile organic compound
PPE – personal protective equipment
USACE – U.S. Army Corps of Engineers

Table 8.2
Detailed Evaluation of Sediment Remedial Alternatives for Lower Ley Creek

<u>Evaluation Criteria</u>	<u>Soil Alternative 1</u> **No Action**	<u>Sediment Alternative 2</u> **Removal of All Sediments to Cleanup Goals**	<u>Sediment Alternative 3</u> **Granular Material Sediment Cap**	<u>Sediment Alternative 4</u> **Engineered Bentonite Sediment Cap**	<u>Sediment Alternative 5</u> **Monitored Natural Recovery**
Overall Protection of Human Health and the Environment	The No Action Alternative would not be protective of human health and the environment, because this would not actively address the contaminated sediments that present unacceptable risks of exposure to receptors or the release and transport of COPCs at the site. The RAOs or PRGs would not be met under this alternative.	Excavation to remove all impacted sediments would provide protection of human health and the environment by eliminating the exposure pathways associated with impacted sediments. Backfilling with clean fill would provide habitat for benthic species to colonize.	Sediment capping would provide overall protection of human health and the environment by eliminating the potential human health and ecological exposure pathways associated with impacted sediment. Clean cap material would prevent direct exposure of humans and ecological receptors to contaminated sediment. Reduction in direct exposure to COPCs and potential COPC releases to the water column are expected to reduce risks to fish and to humans and wildlife that consume fish.	Sediment capping would provide overall protection of human health and ecological exposure pathways associated with impacted sediment. Clean cap material would prevent direct exposure of humans and ecological receptors to contaminated sediment. Reduction in direct exposure to COPCs and potential COPC releases to the water column are expected to reduce risks to fish and to humans and wildlife that consume fish.	MNR of the creek sediments would not eliminate the risks to human health and the environment. If completed in conjunction with controls it would protect humans by eliminating the potential human exposure, but would not eliminate the exposures to the environment. Environmental exposures would be expected to drop due to natural processes in the creek (i.e., sedimentation, biodegradation).
Compliance with ARARs	There are no chemical-specific ARARs for sediments. However, there are TBCs (i.e., NYSDEC sediment screening values). The No Action alternative would not meet these TBCs.	• There are no chemical-specific ARARs for sediments. However, there are TBCs (i.e., NYSDEC sediment screening values). Sediment removal would comply with TBCs. • The excavation and backfilling work may result in short-term localized exceedences of surface water criteria due to suspension of impacted sediment during excavation. However, the water quality impacts from excavation would meet the substantive water quality requirements imposed by New York State on entities seeking a dredged material discharge permit under Section 404 of the CWA.	• There are no chemical-specific ARARs for sediments. However, there are TBCs (i.e., NYSDEC sediment screening values). Sediment capping would comply with TBCs. • Sediment caps are routinely installed in compliance with ARARs and TBCs, which would include the substantive requirements of the dredge and fill permit program under Section 404 of the CWA.	• There are no chemical-specific ARARs for sediments. However, there are TBCs (i.e., NYSDEC sediment screening values). Sediment capping would comply with TBCs. • Sediment caps are routinely installed in compliance with ARARs and TBCs, which would include the substantive requirements of the dredge and fill permit program under Section 404 of the CWA.	There are no chemical-specific ARARs for sediments. However, there are TBCs (i.e., NYSDEC sediment screening values). The MNR alternative would not meet these TBCs.
Long-Term Effectiveness and Permanence	This alternative does not provide significant long-term effectiveness. The creek would be expected to continue to improve naturally over time. However, it would not effectively eliminate the potential exposure to contaminants in sediment. The rate of improvement is unpredictable and would not be verified due to the lack of monitoring under this alternative.	This alternative would provide long-term effectiveness and permanence by eliminating the potential human health and ecological exposure pathways associated with impacted sediment.	• Consistent with EPA design guidance for caps, the sediment cap would be designed to withstand erosional forces resulting from the 100-year return interval storm event. Controls, such as bans on dredging the capped area, would be implemented as necessary to help ensure the long-term integrity of the cap. • As part of a site management plan, maintenance and monitoring program would be implemented to confirm that the sediment cap remains effective over time.	• Consistent with EPA design guidance for caps, the sediment cap would be designed to withstand erosional forces resulting from the 100-year return interval storm event. Controls, such as bans on dredging the capped area, would be implemented as necessary to help ensure the long-term integrity of the cap. • As part of a site management plan, a maintenance and monitoring program would be implemented to confirm that the sediment cap remain effective over time.	• This alternative would not likely provide long-term effectiveness and permanence because the potential human health and ecological exposure pathways associated with impacted sediment would remain at the site for an extended period of time. • Controls, such as bans on dredging and fishing, would be implemented as necessary until monitoring confirms the elimination of the contaminant risks.

Table 8.2 (continued)
Detailed Evaluation of Sediment Remedial Alternatives for Lower Ley Creek

Evaluation Criteria	Soil Alternative 1 No Action	Sediment Alternative 2 Removal of All Sediments to Cleanup Goals	Sediment Alternative 3 Granular Material Sediment Cap	Sediment Alternative 4 Engineered Bentonite Sediment Cap	Sediment Alternative 5 Monitored Natural Recovery
Reduction of Toxicity, Mobility, or Volume through Treatment	The toxicity and volume of COPCs in sediment would not be significantly reduced under the No Action alternative because no treatment would be conducted. The overall bioavailability and mobility of contaminants in the sediment may be reduced over time as some natural recovery processes occur.	Excavation processes would result in reducing the toxicity, mobility, and volume of the sediment. Treatment of water resulting from the excavation would reduce the toxicity, mobility and volume of COPCs that are mobilized from the sediment into the water stream. The greater the volume of sediment removed, the greater the reduction in toxicity, mobility and volume that would result from these processes.	Capping relies on isolation rather than treatment to achieve effectiveness. Capping would result in some reduction in the volume of the impacted sediment due to initial excavation before the installation of the cap. Natural process that reduce toxicity such as biological degradation of organic compounds would continue to occur beneath the cap following construction, although these processes may be insignificant and would not be monitored or verified.	Capping relies on isolation rather than treatment to achieve effectiveness. Capping would result in some reduction in the volume of the impacted sediment due to initial excavation before the installation of the cap. Natural process that reduce toxicity such as biological degradation of organic compounds would continue to occur beneath the cap following construction, although these processes may be insignificant and would not be monitored or verified.	Natural processes that reduce toxicity, such as biological degradation of organic compounds along with sedimentation to reduce the exposure to the contaminants, would continue to occur in the creek and be monitored.
Short-Term Effectiveness	The No Action alternative does not include any physical construction measures in any areas of contamination and, therefore, would not present any potential adverse impacts to the community or workers as a result of its implementation.	• Physical construction of this alternative could likely be completed in approximately two construction seasons. The effects of this alternative during the construction and implementation phase would potentially include: o Impact to local property owners during sediment removals; o Temporary loss of creek habitat; o Temporary impacts of resuspension of COPCs and potential release into the water column during excavation; o Additional potential risk presented by volatilization of organics during excavation and materials handling; o Potential for on-site worker and transportation accidents associated with remedial construction; and o Potential for on-site workers to receive adverse impacts through dermal contact with contaminated sediment. • Excavation, contaminated media handling, and dewatering may create air emissions and odors through release of SVOCs and VOCs from the removed materials. However, significant odors and air emissions are not expected. This short-term impact may be minimized or mitigated through engineering controls including controlled excavation, wearing proper PPE, and adequate monitoring.	• Physical construction of the sediment cap could likely be completed in approximately one construction season. The effects of this alternative during the construction and implementation phase would potentially include: o Impact to local property owners during sediment removals; o Temporary loss of creek habitat; o Temporary impacts of resuspension of COPCs and potential release into the water column during excavation; o Additional potential risk presented by volatilization of organics during excavation and materials handling; o Potential for on-site worker and transportation accidents associated with remedial construction; and o Potential for on-site workers to receive adverse impacts through dermal contact with contaminated sediment. • Excavation, contaminated media handling, and dewatering may create air emissions and odors through release of SVOCs and VOCs from the removed materials. However, significant odors and air emissions are not expected. This short-term impact may be minimized or mitigated through engineering controls including controlled excavation, wearing proper PPE, and adequate monitoring. • The primary short-term negative ecological impact under this alternative would be the temporary elimination of benthic macro invertebrate communities.	• Physical construction of the sediment cap could likely be completed in approximately one construction season. The effects of this alternative during the construction and implementation phase would potentially include: o Impact to local property owners during sediment removals; o Temporary loss of creek habitat; o Temporary impacts of resuspension of COPCs and potential release into the water column during excavation; o Additional potential risk presented by volatilization of organics during excavation and materials handling; o Potential for on-site worker and transportation accidents associated with remedial construction; and o Potential for on-site workers to receive adverse impacts through dermal contact with contaminated sediment. • Excavation, contaminated media handling, and dewatering may create air emissions and odors through release of SVOCs and VOCs from the removed materials. However, significant odors and air emissions are not expected. This short-term impact may be minimized or mitigated through engineering controls including controlled excavation, wearing proper PPE, and adequate monitoring. • The primary short-term negative ecological impact under this alternative would be the temporary elimination of benthic macro invertebrate communities.	• The MNR alternative does not include any physical construction measures in any areas of contamination and, therefore, would not present any potential adverse impacts to the community. • Monitoring activities would present temporary health and safety risks to workers that could easily be addressed with proper work procedures and equipment.

Table 8.2 (continued)
Detailed Evaluation of Sediment Remedial Alternatives for Lower Ley Creek

Evaluation Criteria	Soil Alternative 1 No Action	Sediment Alternative 2 Removal of All Sediments to Cleanup Goals	Sediment Alternative 3 Granular Material Sediment Cap	Sediment Alternative 4 Engineered Bentonite Sediment Cap	Sediment Alternative 5 Monitored Natural Recovery
Implementability	The No Action alternative would be easy to implement as there are no activities to undertake.	• Appropriate excavation and sediment backfilling technologies are readily available and implementable, and construction procedures are well established. Excavation has been demonstrated as an effective remedial technology for impacted sediments at numerous sites. Guidance documents are also available from numerous sources, including the EPA and the USACE, on how to successfully design, construct, and monitor excavation projects. The technology, equipment, subcontractors, personnel, and facilities required to successfully complete this alternative are available in the environmental market place. • Short-term and long-term monitoring of this alternative can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken should the alternative prove to be ineffective or partially ineffective although greater removal volumes would require either longer durations or additional excavation equipment.	• Appropriate sediment capping technologies are readily available and implementable, and construction procedures are well established. Sediment capping using granular material and armor stone has been demonstrated as an effective remedial technology for impacted sediments at numerous sites. The technology, equipment, subcontractors, personnel, and facilities required to successfully complete this alternative are available in the environmental market place. • Short-term and long-term monitoring of this alternative can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken should the alternative prove to be ineffective or partially ineffective.	• Appropriate sediment capping technologies are readily available and implementable, and construction procedures are well established. Sediment capping using engineered bentonite material has been demonstrated as an effective remedial technology for impacted sediments at numerous sites. The technology, equipment, subcontractors, personnel, and facilities required to successfully complete this alternative are available in the environmental market place. • Short-term and long-term monitoring of this alternative can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken should the alternative prove to be ineffective or partially ineffective.	Short-term and long-term monitoring of this alternative can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken should the alternative prove to be ineffective or partially ineffective.
Cost (On-site Disposal)[1]	$ 49,636	$ 7,806,673	$ 10,773,004	$ 10,604,482	$ 1,973,038
Cost (Off-site Disposal)[1]	$ 49,636	$ 16,523,685	$ 17,563,198	$ 15,348,472	$ 1,973,038
State Acceptance	Not evaluated	Not evaluated	Not evaluated	Not evaluated	Not evaluated
Community Acceptance	Not evaluated	Not evaluated	Not evaluated	Not evaluated	Not evaluated

Notes:
[1] Cost calculations for each alternative are presented in Appendix C
COPC – chemical of potential concern
RAO – remedial action objective
PRG – preliminary remediation goal
ARAR – applicable or relevant and appropriate requirement
CWA – Clean Water Act
EPA – U.S. Environmental Protection Agency
SVOC – semi-volatile organic compound
VOC – volatile organic compound
PPE – personal protective equipment
USACE – U.S. Army Corps of Engineers
TBC – To-Be-Considered
NYSDEC – New York State Department of Environmental Conservation

Table 9.1
Comparative Evaluation of Soil Remedial Alternatives for Lower Ley Creek

Evaluation Criteria	Comparative Evaluation
Overall Protection of Human Health and the Environment	• Alternative 1 is not protective of human health and the environment. • Alternative 2 is the most protective because it completely removes the contaminants from the environment where possible. Alternative 3 is slightly less protective of human health and the environment because it removes less contaminants from the soils and relies more on isolation (capping) to eliminate exposure pathways. • Alternative 4 is slightly less protective than Alternatives 2 and 3 because it eliminates the exposure pathways of soil contaminants via isolation (capping) rather than removing them from the environment.
Compliance with ARARs	• Alternative 1 would not meet chemical-specific ARARs or be in compliance with TSCA. • Alternatives 2, 3, and 4 would meet the chemical-specific, location-specific, and action-specific ARARs and be in compliance with TSCA.
Long-Term Effectiveness and Permanence	• Alternative 1 would not provide long-term effectiveness or permanence. Under the remaining alternatives, long-term effectiveness and permanence would depend on the effectiveness of source control (excavation and capping) measures in maintaining reliable protection for human health and the environment once RAOs are met. It is expected that Alternatives 2, 3, and 4 would provide long-term effectiveness and permanence. • With the exception of Alternative 1, long-term monitoring and the implementation of a site management plan would ensure the adequacy and reliability of these actions to control untreated wastes that remain following completion of the remedial action. All Soil Alternatives, with the exception of the No Action Alternative, would require some degree of long-term monitoring. However, Alternative 2 would provide the highest degree of long-term effectiveness and permanence due to the significant reduction is oil contamination via excavation. Alternatives 3 and 4 would require more extensive long-term monitoring activities than Alternative 2 due to monitoring requirements associated with cap maintenance. Alternative 4 would rely only on capping and would therefore require the most extensive long-term monitoring.
Reduction of Toxicity, Mobility, or Volume through Treatment	• Over a long period of time, natural processes would slightly reduce the toxicity, mobility, and volume of contaminants in the soil under Alternative 1. However, they would not be reduced significantly over time and Alternative 1 would not monitor or control these processes. • In comparison with the other alternatives, Alternative 2 would reduce the toxicity, mobility, and volume of impacted soils the greatest through extensive soil excavation. Alternative 3 would also reduce a large volume of the contaminated soils in the environment by excavation in the Southern Swale Soil Area and reduce the mobility of contaminants in the soil by capping in the Northwest Soil Area. • Alternative 4 reduces the mobility of contaminants through soil capping, but has little effect on the toxicity and volume of contaminants.
Short-Term Effectiveness	• The alternative with the least amount of physical construction and material movement (Alternative 1) would have the lowest amount of short-term impacts on the environment. • All the active soil alternatives (2, 3, and 4) would result in short-term habitat destruction and impact to local property owners by either excavation or capping activities. Alternatives 2 and 3 would have the most short-term impacts because excavation activities would elevate short term risks for construction workers, impact local property owners, and result in the temporary loss of habitats. The capping of soils associated with Alternative 4 would have slightly less short-term impacts than the excavation of contaminated soil proposed in Alternatives 2 and 3. • For all alternatives, appropriate measures would be taken to minimize any adverse impacts from soil excavation activities, including measures to prevent transport of fugitive dust and exposure of workers and downgradient receptors to contamination. All of the short-term impacts can be minimized or mitigated by exercising sound engineering practices, following appropriate health and safety protocols, wearing proper PPE, and adequate monitoring.
Implementability	• No technical or administrative issues have been identified that would limit the feasibility of implementing Alternative 1. • Appropriate soil excavation technologies are readily available and implementable for Alternatives 2 and 3. The size and duration of the removal activities in Alternative 2 would present more implementation challenges than the other three alternatives. • Appropriate soil capping technologies are readily available and implementable for Alternatives 2, 3, and 4. • Short-term and long-term monitoring as part of a site management plan for Alternatives 2, 3, and 4 can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken, should the alternatives prove to be ineffective or partially ineffective.

Table 9.1 (continued)
Comparative Evaluation of Soil Remedial Alternatives for Lower Ley Creek

Evaluation Criteria	Comparative Evaluation
Cost	• Capital costs for soil removal, off-site transportation, and disposal or treatment are higher compared to costs involving installation of a soil cap over equivalent target areas. Operation and maintenance costs for a soil removal alternative will be lower than for implementation of a soil capping alternative for an equivalent area, as removal-only alternatives do not require long-term maintenance. • Soil cap installation costs are also included as part of this remedial alternative. Costs for soil capping alternatives vary primarily with the total area covered. Operation and maintenance costs for a soil cap alternative will be higher than for a soil removal alternative involving the same areas because of soil cap maintenance costs, institutional controls, and the implementation of a site management plan. • <u>On-site Disposal</u> o The cost estimates for each soil remedial alternative are detailed in Appendix C, Table C-1. The alternatives with the least amount of construction and off-site disposal activity are the least costly to implement. Alternative 1 is the least costly. Alternative 2 includes the largest amount of excavation and disposal of impacted soils and therefore carries the highest cost. Alternative 3, which proposes a mix of excavation and capping activities, is the next costliest alternative. Finally, Alternative 4 (Capping of Soils) is higher in cost than the no action alternative but is less costly than the excavation alternatives because of the reduced excavation costs. • <u>Off-site Disposal</u> o The cost estimates for each soil remedial alternative are detailed in Appendix C, Table C-3. The alternatives with the least amount of construction and off-site disposal activity are the least costly to implement. Alternative 1 is the least costly. Alternative 2 includes the largest amount of excavation and disposal of impacted soils and therefore carries the highest cost. Alternative 3, which proposes a mix of excavation and capping activities, is the next costliest alternative. Finally, Alternative 4 (Capping of Soils) is higher in cost than the no action alternative but is significantly less costly than the excavation alternatives because of the reduced waste disposal costs.

Notes:
RAO – remedial action objective
ARAR – applicable or relevant and appropriate requirement
PPE – personal protective equipment
TSCA – Toxic Substances Control Act

Table 9.2
Comparative Evaluation of Sediment Remedial Alternatives for Lower Ley Creek

Evaluation Criteria	Comparative Evaluation
Overall Protection of Human Health and the Environment	• Alternative 1 is not protective of human health and the environment. • Alternative 2 is the most protective because it provides complete removal of the contaminants from the environment where possible. • Alternatives 3 and 4 are slightly less protective than Alternative 2 because they eliminate the exposure pathways of sediment contaminants rather than removing contaminants from the environment. • Alternative 5 is not protective of human health and the environment
Compliance with ARARs	• There are no chemical-specific ARARs for sediments. However, there are TBC values (i.e., NYSDEC sediment screening values). Alternative 1 would not meet TBC sediment screening values or be in compliance with TSCA. • Sediment removal in Alternative 2 would comply with TBCs and be in compliance with TSCA. The excavation and backfilling work may result in short-term localized exceedences of surface water criteria due to suspension of impacted sediment during excavation. However, the water quality impacts from excavation would meet the substantive water quality requirements imposed by New York State on entities seeking a dredged material discharge permit under Section 404 of the CWA. • Sediment caps in Alternatives 3 and 4 are routinely installed in compliance with ARARs and TBCs, which would include the substantive requirements of the dredge and fill permit program under Section 404 of the CWA. • There are no chemical-specific ARARs for sediments. However, there are TBC values (i.e., NYSDEC sediment screening values). Alternative 5 would not meet TBC sediment screening values or be in compliance with TSCA.
Long-Term Effectiveness and Permanence	• Alternative 1 would not provide long-term effectiveness or permanence. Alternative 2 provides the most long-term effectiveness and permanence because it permanently removes all the contaminants in sediments. • Consistent with EPA design guidance for caps, the sediment caps and backfill areas associated with Alternatives 3 and 4 would be designed to withstand erosional forces resulting from the 100-year return interval storm event. Institutional controls, such as bans on dredging the capped or backfilled areas, would be implemented as necessary to help ensure the long-term integrity of these barriers. • With the exception of Alternative 1, long-term monitoring and the implementation of a site management plan would ensure the adequacy and reliability of these actions to control untreated wastes that remain. Alternative 2 would require the least amount of long-term monitoring because all of the contaminated sediments would be removed. Alternatives 3 and 4 would require the most amount of long-term monitoring because most of the contaminated sediments would be left in place. A site management plan would needs to be implemented under these alternatives to ensure the effectiveness and permanence of the sediment caps. • Alternative 5 would not provide long-term effectiveness or permanence.
Reduction of Toxicity, Mobility, or Volume through Treatment	• Over a long period of time, natural processes would slightly reduce the toxicity, mobility, and volume of contaminants in the sediment under Alternative 1. However, they would not be reduced significantly over time and Alternative 1 would not monitor or control these processes. • In comparison with the other alternatives, Alternative 2 would reduce the toxicity, mobility, and volume of impacted soils the greatest through extensive sediment excavation. • Alternatives 3 and 4 reduce the mobility of contaminants through sediment capping, but have little effect on the toxicity and volume of contaminants. • Over a long period of time, natural processes would slightly reduce the toxicity, mobility, and volume of contaminants in the sediment under Alternative 5 and this alternative would monitor and control these processes.
Short-Term Effectiveness	• The alternative with the least amount of physical construction and material movement (Alternative 1) would have the lowest amount of short-term impacts on the environment. • All the other alternatives would result in short-term habitat destruction and impact to local property owners by either excavation or capping activities. Alternative 2 would have the most short-term impacts because excavation activities would elevate short term risks for construction workers, impact local property owners, and lead to the temporary loss of habitats. The capping of sediments associated with Alternatives 3 and 4 would have slightly less short-term impacts than the excavation of contaminated sediments proposed in Alternative 2. • For all alternatives, the short-term impacts would be minimized or mitigated by exercising sound engineering practices, following appropriate health and safety protocols, wearing proper PPE, and adequate monitoring. • Alternative 5 does not include any physical construction measures in any areas of contamination and, therefore, would not present any potential adverse impacts to the community.

Evaluation Criteria	Comparative Evaluation
Implementability	• No technical or administrative issues have been identified that would limit the feasibility of implementing Alternative 1. • Appropriate sediment excavation technologies are readily available and implementable for Alternative 2. The size and duration of the removal activities in Alternative 2 would present more implementation challenges than the other alternatives. • Appropriate sediment capping technologies are readily available and implementable for Alternatives 3 and 4. • Short-term and long-term monitoring as part of a site management plan for Alternatives 3 and 4 can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken, should the alternatives prove to be ineffective or partially ineffective. • Short-term and long-term monitoring for Alternative 5 can be easily implemented to verify effectiveness. Additional remedial actions can readily be undertaken should the alternative prove to be ineffective or partially ineffective.
Cost	• For the granular/armor sediment capping alternative (Alternative 3), the requirements of 2 ft of habitat material, armoring requirements, isolation thickness requirements, along with the need to excavate additional sediments to maintain the bathymetry of the creek; causes this alternative to be more expensive than the excavation alternative. • The requirement of 2 ft of habitat material above the engineered bentonite capping alternative (Alternative 4), along with the need to excavate additional sediments to maintain the bathymetry of the creek causes this alternative to be more expensive than the excavation alternative (Alternative 2). • Operation and maintenance costs for a sediment removal alternative will be lower than for implementation of a capping alternative for an equivalent area, as removal-only alternatives do not require long-term maintenance. • Operation and maintenance costs for a capping alternative will be higher than for a sediment removal alternative involving the same areas because of site management costs and, to a lesser extent, potential cap maintenance required in the long term. • The cost estimates for each sediment remedial alternative are detailed in Appendix C. There are significant relevant differences between the alternatives depending on on-site disposal of contaminated sediment or off-site disposal. • <u>On-site Disposal</u> o The cost estimates for each sediment remedial alternative are detailed in Appendix C, Table C-2. Alternative 1 is the least costly alternative, followed by Alternative 5. Although Alternative 2 includes the largest amount of excavation, the lack of required capping materials for backfill leads to the overall cost of this alternative being less than the capping alternatives. Alternatives 3 and 4 (Capping of Sediments) are higher in costs than the other alternatives. Because Capping Alternative 4 requires less sediment removal than Capping Alternative 3, it has a slightly lower overall cost. • <u>Off-site Disposal</u> o The cost estimates for each sediment remedial alternative are detailed in Appendix C, Table C-4. Alternative 1 is the least costly alternative, followed by Alternative 5. Although Alternative 2 includes the largest amount of excavation, the lack of required capping materials for backfill leads to the overall cost of this alternative being less than the Granular Material Cap Alternative (Alternative 3) but slightly higher than the Engineered Bentonite Cap Alternative (Alternative 4). Because Capping Alternative 4 requires less sediment removal than Capping Alternative 3, it has a lower overall cost.

Notes:
ARAR – applicable or relevant and appropriate requirement
CWA – Clean Water Act
PPE – personal protective equipment
TBC – To-Be-Considered
NYSDEC – New York State Department of Environmental Conservation
MNR – Monitored Natural Recovery

APPENDIX A

Identification of Federal and State Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBCs)

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LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirements
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CEQ	Council of Environmental Quality
CESQG	conditionally exempt small quantity generator
CFR	Code of Federal Regulations
CWA	Clean Water Act
DDT	dichlorodiphenyltrichloroethane
DEC	Department of Environmental Conservation
DOT	U.S. Department of Transportation
ECL	Environmental Conservation Law
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FWCA	Fish and Wildlife Coordination Act
HMTA	Hazardous Materials Transportation Act
LDR	land disposal restrictions
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NYCRR	New York Codes, Rules and Regulations
NYSFWL	New York State Freshwater Wetlands Law
PCB	polychlorinated biphenyls
ppm	parts per million
RAA	remedial action alternatives
RAO	remedial action objectives
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
SCA	sediment consolidation area
SPDES	State Pollution Discharge Elimination System
SWDA	Safe Drinking Water Act
TBC	To Be Considered
TSCA	Toxic Substances Control Act

USACE	U.S. Army Corps of Engineers
USC	United States Code

APPENDIX A

IDENTIFICATION OF FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED

LOWER LEY CREEK SUBSITE OF THE ONONDAGA LAKE SUPERFUND SITE, SYRACUSE, NY

1.0 INTRODUCTION

The remediation of Lower Ley Creek is subject to federal and state environmental statutes and regulations designated for Lower Ley Creek in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) process for determining applicable or relevant and appropriate requirements (ARAR). Section 121(d)(1) of CERCLA, Title 42 of the United States Code (USC), Section 9621(d)(1), 42 USC § 9621(d)(1), requires that response actions attain a degree of cleanup that assures protection of human health and the environment.

CERCLA also requires that response actions at least attain federal ARARs as well as any state ARARs that are more stringent than federal ARARs (unless an ARAR waiver becomes necessary). The National Contingency Plan (NCP) regulations, Title 40 of the Code of Federal Regulations (CFR) Part 300, [40 CFR § 300.435(b)(2)] which implement CERCLA's cleanup requirements, generally require ARAR compliance. Three categories of potentially applicable federal and state requirements and guidance were reviewed for this site: (1) chemical-specific; (2) location-specific; and (3) action-specific ARARs and To Be Considered (TBC). These are the same requirements assessed for each site regulated under CERCLA. CERCLA (42 USC § 9621(d)) and the NCP (40 CFR § 300.400(e)) provide that permits are not required for on-site response actions under CERCLA. The U.S. Environmental Protection Agency (EPA) has interpreted this exemption to "*to waive the requirement to obtain a permit but not the substantive requirements that would be applied through permits*." (see, e.g., Management of Remediation Waste Under CERCLA, EPA, October 1998).

In addition to ARARs, advisories, criteria, or guidance may be evaluated as TBC regulatory items. The NCP provides that the TBC category may include advisories, criteria, or guidance that were developed by EPA, other federal agencies, states, or local governments that may be useful in devising CERCLA remedies. These TBCs are not promulgated and, therefore, are not legally enforceable standards such as ARARs.

Consistent with EPA guidance, ARAR development and designation is a necessarily iterative process.

2.0 ARAR AND TBC IDENTIFICATION

2.1 CHEMICAL-SPECIFIC ARARs AND TBCs

Chemical-specific ARARs are numerical values, established by promulgated standards, which are required to be used to set acceptable concentrations of chemicals that may be found in or discharged to the environment. Potential federal and state chemical-specific ARARs and TBCs associated with a remedial action for Lower Ley Creek are listed in Tables A-1 and A-2, respectively. These tables list each chemical-specific ARAR for this response action and provide a citation and a brief description and/or comment on the intended operation of that ARAR or TBC, where warranted.

The analysis of chemical-specific ARARs is provided below in the order provided in the Remedial Investigation (RI) Report:

2.1.1 Air

There are no promulgated chemical-specific ARARs for air.

2.1.2 Biota

There are no promulgated chemical-specific ARARs for biota.

2.1.3 Sediment

There are no promulgated chemical-specific ARARs for sediment.

2.1.4 Federal--Safe Drinking Water Act Regulations, 40 CFR Part 141

Summary

The Safe Drinking Water Act (SWDA) is intended to protect human health from contaminants through a system of drinking water standards measured at the tap (i.e., the National Primary Drinking Water Regulations), as well as through a number of other provisions that do not pertain to this site.

Analysis

The groundwater in the vicinity is considered potential potable water; therefore, the maximum contaminant levels and maximum contaminant level goals are relevant and appropriate.

For Lower Ley Creek, these SDWA standards are not applicable because they do not meet all the necessary jurisdictional requirements. Neither the creek surface water nor groundwater that eventually reaches the creek is used as a source of potable water. In addition, there is no existing plan to use Lower Ley Creek as a future source of potable water because there are other more suitable and readily available sources of potable water for the Syracuse area. Local water users receive public water from the Onondaga County Water Authority. The municipal water supply for Onondaga County comes from Otisco and Skaneateles Lakes and from Lake Ontario, all of which are located more than twenty miles away from Lower Ley creek. In addition, the

New York State Atlas of Community Water System Sources does not list any municipal or non-municipal community water supply intakes in Onondaga County that could be impacted by Lower Ley Creek.

ARAR Determination

The SDWA and the SDWA regulations will be treated as a potential relevant and appropriate chemical-specific ARAR for the on-site Lower Ley Creek remediation.

2.1.5 Federal--Clean Water Act Regulations, 40 CFR Part 129

Summary

Part 129 of the federal Clean Water Act (CWA) regulations provides six specific Toxic Pollutant Effluent Standards that apply to the owners or operators of a building, structure, facility, or installation. Toxic Pollutant Effluent Standards in the federal CWA are provided for aldrin/dieldrin, dichlorodiphenyltrichloroethane (DDT), endrin, toxaphene, benzidene and polychlorinated biphenyls (PCB), all of which adhere readily to sediment particles and are typically non-detectable in water samples.

Analysis

The CWA regulations may be relevant and appropriate for aldrin/dieldrin, DDT, endrin, toxaphene, benzidene, and PCBs detected in Lower Ley Creek.

For Lower Ley Creek, these CWA regulations rely on the National Pollutant Discharge Elimination System (NPDES) permit program to implement the related prohibition on the point source discharge of these pollutants. As such, these CWA regulations are not applicable because they do not meet all the necessary jurisdictional requirements.

ARAR Determination

Based on the analysis above, the CWA and the CWA regulations in 40 CFR Part 129 regulations are relevant and appropriate chemical-specific ARARs for purposes of the on-site Lower Ley Creek remediation.

2.1.6 State--New York State Regulations, 6 NYCRR Parts 608, 700-706

Summary

- Part 608 includes the requirement to obtain a State Pollution Discharge Elimination System (SPDES) permit for certain discharges in any navigable waters of the State (6 New York Codes, Rules, and Regulations [NYCRR] 608.5). The standards for issuance of such a permit are general in nature and include environmental impacts and effect on water quality (6 NYCRR 608.7 and 8).
- The regulations in Parts 700 – 706 include water quality classifications, standards and guidance values.
- Part 700 provides definitions and describes collection and sampling procedures.
- Part 701 establishes classifications for surface waters and groundwater.

- Part 702 establishes the deviation and use of these standards and guidance values.
- Part 703 establishes surface water and groundwater quality standards and groundwater effluent limitations.
- Part 704 establishes criteria for thermal discharges.
- Part 705 contains references.
- Part 706 establishes additional procedures for the derivation of standards and guidance values that are protective of aquatic life from acute and chronic effects.

Analysis

- Substantive provisions of 6 NYCRR Part 608 that appear relevant and appropriate in the context of this on-site response action are:
    - Section 608.6(a) (requiring development and submission of a sufficiently detailed construction plan with a map).
    - Section 608.9(a) (requiring that construction or operation of facilities that may result in a discharge to navigable waters demonstrate compliance with CWA §§ 301-303, 306 and 307 and 6 NYCRR § 751.2 (prohibited discharges) and 754.1 (effluent prohibitions; effluent limitations and water quality-related effluent limitations; pretreatment standards; standards of performance for new sources.)
- Parts 700 and 705 are not applicable or relevant and appropriate because they are administrative or procedural in nature.
- In Part 701, the descriptions of the classifications assigned to waters of the State, including the classifications assigned to the creek, as well as a general prohibition on any discharge that impairs the receiving water for its assigned best usages are relevant and appropriate ARARs.
- Part 702 includes procedures used for deriving water quality standards and guidance values, which are not applicable or relevant and appropriate because they are administrative or procedural in nature.
- Part 703 includes general and chemical-specific water quality standards and is relevant and appropriate.
- Part 704 would not be relevant and appropriate to alternatives involving dredging, dewatering and discharge to the creek because no thermal discharges are otherwise anticipated as a result of the cleanup of the site.
- Part 706 includes procedures for developing water quality standards and guidance values to protect aquatic life which are not applicable or relevant and appropriate because they are administrative or procedural in nature.

ARAR Determination

Substantive provisions of 6 NYCRR §§ 608.6(a) and 608.9(a) are potential relevant and appropriate chemical-specific ARARs for the on-site response. In addition, substantive provisions in Parts 703 and 704 are potential relevant and appropriate chemical-specific ARARs for the on-site response.

2.2 LOCATION-SPECIFIC ARARs AND TBCs

Location-specific ARARs may restrict the conduct of activities or concentrations of hazardous substances based solely on the particular characteristics of a site. Potential federal and state location-specific ARARs and TBCs considered in connection with the Lower Ley Creek response action are listed in Tables A-3 and A-4, respectively. These tables list each location-specific ARAR, and provide a regulatory citation and brief description and/or comment on the intended operation of that ARAR or TBC, where warranted. The determination of the potential use of each recommended ARAR is summarized in the status column of each table.

2.2.1 Federal--Executive Order No. 11988, Floodplain Management, 42 Federal Register 26951 (May 25, 1977)

Summary

This Executive Order provides the circumstances where federal executive agencies should manage floodplains.

Analysis

This Executive Order is technically a TBC. It is applicable because the EPA is a federal executive agency. The Executive Order also is relevant and appropriate because federal money is expected to be used for this cleanup.

ARAR Determination

Federal Executive Order 11988 is a TBC for the Lower Ley Creek remediation.

2.2.2 Federal--Executive Order No. 11990, Protection of Wetlands, 42 Federal Register 26961 (May 25, 1977)

Summary

This Executive Order provides the circumstances where federal executive agencies should protect wetlands.

Analysis

This Executive Order is technically a TBC. It is applicable because the EPA is a federal executive agency. The Executive Order also is relevant and appropriate because federal money is expected to be used for this cleanup.

ARAR Determination

This Federal Executive Order is a TBC for the Lower Ley Creek remediation.

2.2.3 Federal--EPA Regulations, 40 CFR Part 6, Subpart A

Summary

These regulations describe EPA procedures for implementing the requirements of the Council of Environmental Quality (CEQ) on the National Environmental Policy Act (NEPA.)

Analysis

These EPA regulations may be relevant and appropriate for purposes of enhancing the NCP process, depending on the location of on-site remedial action alternatives (RAA). Subpart A of Part 6 is not applicable because these EPA regulations are intended to implement NEPA and the related CEQ regulations in 40 CFR Parts 1500-1517; however, NEPA and the NEPA regulations are inapplicable here since CERCLA and the NCP solely govern this remediation.

ARAR Determination

Subpart A of 40 CFR Part 6 will be treated as a potential relevant and appropriate location-specific ARAR for on-site response at Lower Ley Creek depending on the circumstances.

2.2.4 Federal--Fish and Wildlife Coordination Act, 16 USC § 662 Summary

The Fish and Wildlife Coordination Act (FWCA) requires consultation with the U.S. Fish and Wildlife Service whenever a public or private agency, under a federal permit or license, seeks to impound, divert, deepen, control, or modify any body of water.

Analysis

Substantive, non-procedural, non-permit related provisions of 16 USC § 662 may be relevant and appropriate as a location-specific ARAR for the on-site response, depending on the remedial action objectives (RAO) and location(s) chosen for cleanup of the site. The permit-related requirements of Section 662 are not applicable because this statute is predicated on a FWCA permit being required as well as the FWCA directly controlling any of the specified actions that might lawfully proceed.

ARAR Determination

Section 662 may be applicable or relevant and appropriate as a location-specific ARAR for any off-site response that may occur as part of remediation of the site, depending on the location(s) chosen for managing site residuals.

2.2.5 Federal--Fish and Wildlife Coordination Act Regulations, 40 CFR § 6.302

Summary

This federal statute requires EPA to apply Executive Order 11990, *Protection of Wetlands*, Executive Order 11988, *Floodplain Management*, the EPA Policy to Protect Environmentally Significant Agricultural Lands, the Coastal Zone Management Act, and the Wild and Scenic Rivers Act in EPA administrative programs in circumstances where these apply.

Analysis

This regulation is neither applicable nor relevant and appropriate as a potential location-specific ARAR for this site because there are no wild and scenic rivers, coastal barriers, wilderness areas or significant agricultural lands on-site.

ARAR Determination

These FWCA regulations are not a location-specific ARAR for the Lower Ley Creek remediation.

2.2.6 Federal--National Historic Preservation Act Regulations, 36 CFR Part 800

Summary

The National Historic Preservation Act (NHPA) was adopted to implement the NHPA and to preserve for public use historic and cultural sites of national significance by requiring federal agencies, among other things, to preserve all historic properties that they own and control, notify the federal Department of the Interior of projects that will cause the loss of significant historic materials, and request preservation assistance from the Department of the Interior.

Analysis

Whether cultural resources exist along the Lower Ley Creek riparian corridor continues to be assessed. A Stage IA cultural resource survey may need to be performed for the project area.

ARAR Determination

Until contrary information becomes known, the NHPA regulations will be treated as applicable location-specific ARARs for the Lower Ley Creek remediation.

2.2.7 State--New York State Freshwater Wetlands Law Regulations, 6 NYCRR Parts 662 – 665

Summary

Part 662 of New York State Freshwater Wetlands Law (NYSFWL) provides interim permit procedures for freshwater wetlands. Part 663 provides the state freshwater wetland permit requirements. Part 664 provides the state freshwater wetlands maps and classification procedures. Part 665 provides the state regulatory procedures for local government implementation of the Freshwater Wetlands Act and statewide minimum land-use regulations for freshwater wetlands.

Analysis

- Substantive provisions of 6 NYCRR Parts 662-664 may be relevant and appropriate as potential location-specific ARARs for on-site response, depending on the locations chosen for cleanup actions.
- Provisions of 6 NYCRR Parts 662-665 may be applicable as potential location-specific ARARs for off-site remedial actions.
- The permit-related requirements of Parts 662 and 663 are not applicable because these regulations are predicated on the NYSFWL being directly controlling, and on a FWCA permit being required before any of the specified actions might lawfully proceed.
- In Part 664, the mapping and classification procedures are not applicable on-site because they are designed to further the permitting system, which is inapplicable on-site.
- Part 665 is neither applicable nor relevant and appropriate because the EPA is not a local government, and local government wetland or land-use regulations are not ARARs under CERCLA.

Other aspects of these regulations may be ARARs, depending on the circumstances, as described below.

ARAR Determination

Substantive, non-procedural, non-permit related provisions of 6 NYCRR Parts 662-664 may be relevant and appropriate as potential location-specific ARARs for on-site response, depending on the RAOs and location(s) chosen for cleanup of the site. Provisions of 6 NYCRR Parts 662-665 may be applicable or relevant and appropriate as location-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the location(s) chosen for managing site residuals.

2.2.8 State--New York State Regulations, 6 NYCRR § 373-2.2 - 100-Year Floodplain

Summary

Section 373-2.2 is part of 6 NYCRR Subpart 373-2, the Final Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities. Subsection 3732.2(j) provides that hazardous waste facilities located in the 100-year floodplain must be designed, constructed, and operated to prevent washout in a 100-year flood, except in limited circumstances with the Department of Environmental Conservation's (DEC's) approval.

Analysis

Substantive, non-procedural, non-permit related provisions of 6 NYCRR § 373-2.2(j) may be relevant and appropriate as a location-specific ARAR for the on-site response, depending on the RAAs and location(s) chosen for cleanup of the site. Provisions of 6 NYCRR § 373-2.2 may be applicable or relevant and appropriate as location-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the location(s) chosen for managing site residuals.

Subsection 373-2.2(j) is not applicable because the state is not the regulating authority under CERCLA at this site and any hazardous substance facility constructed on-site will not be directly subject to state hazardous waste regulation and control.

Other aspects of these regulations may be ARARs, depending on the circumstances, as described below.

ARAR Determination

Substantive provisions of 6 NYCRR §373-2.2 may be relevant and appropriate as a location-specific ARAR for the on-site response, depending on the RAAs and location(s) chosen for cleanup of the site.

2.2.9 State--New York State Regulations, 6 NYCRR Part 182

Summary

- Part 182 provides references in Section 182.1.
- Section 182.2 provides definitions.
- Section 182.3 prohibits the taking, importing, transporting, possessing or selling of any endangered or threatened species of fish or wildlife without a DEC permit.
- Section 182.4 provides license and permit procedures.
- Section 182.5 provides special rules for the importing or possession of an alligator, caiman or crocodile.
- Section 182.6 designates certain endangered species, threatened species and species of special concern in the state.
- Section 182.7 establishes special rules for lake sturgeon.

Analysis

- Substantive, non-procedural, non-permit related provisions of 6 NYCRR §§ 182.3 and 182.6 may be relevant and appropriate as location-specific ARARs for the on-site response, depending on the RAOs and location(s) chosen for cleanup of the site.
- Provisions of 6 NYCRR § 182.3, 182.4 and 182.6 may be applicable or relevant and appropriate as location-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the RAOs and location(s) where site residuals are to be managed.
- Sections 182.1 and 182.2 are not ARARs because they are purely administrative or procedural in nature.

- The substance of the non-permit/license- related portions of Section 182.3 is not applicable on-site because they are designed to further the permitting system, which is inapplicable on-site.
- Provisions of Section 182.5 for alligators, caimans, and crocodiles are not ARARs because these species are not found at, nor do they have appropriate habitat within Lower Ley Creek throughout any of their life cycles.
- For similar reasons, the Section 182.7 special provisions for lake sturgeon are not an ARAR.
- The Section 182.6 classification system is not applicable on-site because they are designed to further the permitting system, which is inapplicable on-site.

Other aspects of these regulations may be ARARs, depending on the circumstances, as described below.

ARAR Determination

- Substantive provisions of 6 NYCRR §§ 182.3 and 182.6 may be relevant and appropriate as location-specific ARARs for the on-site response, depending on the RAOs and location(s) chosen for cleanup of the site.
- Provisions of 6 NYCRR §§ 182.3, 182.4 and 182.6 may be applicable or relevant and appropriate as location-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the RAOs and location(s) where site residuals are to be managed.

2.2.10 Endangered Species Act, 16 USC §§ 1531 et. seq.

Summary

The Endangered Species Act (ESA) consists of:

- A statement of Congressional findings and declaration of purposes (16 USC § 1531).
- Definitions (16 USC § 1532).
- A general description of the process for determination of endangered species and threatened species (16 USC § 1533).
- Establishes a process to promote the acquisition of land for the preservation of endangered species and threatened species (16 USC § 1534).
- A process to promote state, interagency and international cooperation on endangered species and threatened species issues (16 USC §§ 1535 - 1537).
- A process for implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (16 USC § 1537a).
- Prohibited acts with respect to endangered species and threatened species (16 USC § 1538).
- Exceptions to the ESA (16 USC § 1539).

- Penalties and enforcement of the ESA (16 USC § 1540).
- Review of endangered plants (16 USC § 1541).
- Authorization for appropriations (16 USC § 1542).
- Construction of the ESA with the Marine Mammal Protection Act (16 USC § 1543).
- Provides for an annual accounting of Federal and State expenditures for the conservation of endangered or threatened species (16 USC § 1544).

Analysis

- The prohibition in Section 1538 of certain acts with respect to endangered species and threatened species constitutes substantive environmental protection requirements, which are relevant and appropriate requirements.
- The permit-related requirements of Section 1539 are not applicable because these requirements are predicated on ESA being directly controlling, and on an ESA permit being required before any of the specified actions might lawfully proceed. However, other aspects of Section 1539 may be relevant and appropriate as location-specific ARARs, depending on the circumstances, as described below.
- Sections 1531-1537a and 1540-1544 are not cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal environmental or state environmental or facility siting law.

ARAR Determination

The prohibitions in Section 1538 of certain acts with respect to endangered species and threatened species are applicable as a potential location-specific ARAR for the Lower Ley Creek site remediation.

Sections 1531-1537a and 1540-1544 are not applicable or relevant and appropriate location-specific ARARs.

Substantive provisions of Section 1539 may be relevant and appropriate as a location-specific ARAR for the on-site response, depending on the RAOs and the relationship to critical habitat at the site.

The provisions of Section 1539 also may be applicable or relevant and appropriate as a location-specific ARAR for any off-site response that may occur as part of remediation of the site, depending on the location(s) chosen for managing site residuals and relationship to off-site critical habitat.

2.2.11 Federal--Clean Water Act Regulations, 33 CFR Parts 320- 330 and 40 CFR Part 230 and 231

Summary

In 33 CFR:

- Part 320 establishes the U.S. Army Corp of Engineers' (USACE) general regulatory policies.
- Part 321 establishes requirements for permits for dams and dikes in navigable waters of the United States.
- Part 322 establishes requirements for permits for structures or work in or affecting navigable waters of the United States.
- Part 323 provides definitions that pertain to the CWA Section 404 program for discharges of dredged or fill material and specifies the activities that do not require permits.
- Part 324 establishes requirements for permits for ocean dumping of dredged materials.
- Part 325 establishes requirements for the processing of USACE permits.
- Part 326 establishes requirements for enforcement of wetland dredge and fill permits.
- Part 327 establishes requirements for hearings on wetland dredge and fill permits.
- Part 328 establishes the definition of waters of the United States.
- Part 329 establishes the definition of navigable waters of the United States.
- Part 330 establishes the nationwide permit program.

In Title 40 of the CFR:

- Part 230 sets forth the CWA Section 404(b)(1) guidelines for specification of disposal sites for dredged or fill material, and implements 33 USC § 1344 for the review of proposed discharges of dredged or fill material into navigable waters.
- Part 231 sets forth the CWA Section 404(c) requirements for EPA's procedures prohibiting or withdrawing the specification, or denying, restricting, or withdrawing the use for specification of any defined area as a disposal site for dredged or fill material.

Analysis

- Substantive aspects of the statement of regulatory policy in 33 CFR 320 and the guidelines in 40 CFR Part 230 may be relevant and appropriate location-specific requirements depending on the RAA.
- Part 324 is not an action-specific ARAR because this site is not located on an ocean.
- Parts 231 and 325 are not location-specific ARARs because they are procedural in nature.
- Parts 326 and 327 are not location-specific ARARs because they only relate to enforcement or hearing procedures.

- While not applicable, the regulatory definitions or exclusions from CWA dredge and fill regulations in Parts 323, 328, 329 and 330 may be relevant and appropriate location-specific requirements depending on the RAA.
- Parts 321 and 322 are not applicable location-specific ARARs at this CERCLA site because these regulations are predicated on the CWA regulations being directly controlling and on a CWA permit being required before any of the specified actions might lawfully proceed. However, it is solely CERCLA that controls actions at this site; other laws may pertain to this site only to the extent allowed by 42 USC § 9621(d), and the NCP in 40 CFR § 300.400(e) explicitly provides that permits are not required for on-site response actions under CERCLA. Therefore, all permit-related requirements of Parts 321 and 322 are not applicable as location-specific ARARs the on-site response actions.

Other aspects of these standards may be ARARs, depending on the circumstances, as described below.

ARAR Determination

- Substantive provisions of Parts 321 and 322 may be relevant and appropriate as location-specific ARARs for the on-site response, depending on the RAOs and technology chosen for cleanup of the site.
- Provisions of Parts 321-323, 329-330 may be applicable or relevant and appropriate as location-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

2.3 ACTION-SPECIFIC ARARs AND TBCs

Action-specific ARARs generally set performance or design standards, controls, or restrictions on particular types of activities. To develop technically feasible alternatives, applicable performance or design standards must be considered during the development of all reasonable response action alternatives. The precise action-specific ARARs for this site will be subsequently determined based upon the technology or technologies chosen to remediate the site.

Potential federal and state action-specific ARARs and TBCs evaluated in connection with this response action are listed in Tables A-5 and A-6, respectively. These tables list each action-specific ARAR and TBC for remediation of Lower Ley Creek and provide a regulatory citation and a brief description and/or comment on the intended operation of each ARAR or TBC, where warranted. The determination of the potential use of each recommended ARAR is provided in the status column of each table.

2.3.1 Federal--Toxic Substances Control Act Regulations, 40 CFR Part 761

Summary

Toxic Substance Control Act (TSCA) Part 761 generally contains the federal regulations on the manufacturing, processing, and distribution of certain toxic substances in commerce and use prohibitions and includes in pertinent part:

- Section 761.65 establishing the TSCA requirement for PCB storage for disposal.
- Section 761.70 establishing the TSCA requirement for PCB incineration.
- Section 761.71 establishing the TSCA requirement for disposal of PCBs in high efficiency boilers.
- Section 761.72 establishing the TSCA requirement for disposal of PCBs in scrap metal recovery ovens and smelters.
- Section 761.75 establishing the TSCA requirement for disposal of PCBs in chemical waste landfills.

Analysis

The PCB regulations in 40 CFR §§ 761.65-761.75 are applicable because some of the creek sediment samples analyzed contain more than 50 parts per million (ppm) of PCBs, which is the trigger concentration for PCB spill remediation to occur. None of the non-PCB regulations in Part 761 are applicable because they do not meet the necessary jurisdictional requirements since none of those substances were detected at the site at close to the actionable levels listed in these regulations. Other aspects of these regulations may be ARARs, depending on the circumstances, as described below.

Substantive, non-procedural, non-permit related provisions of 40 CFR §§ 761.65-761.75 may be relevant and appropriate as an action-specific ARARs for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of 40 CFR §§ 761.65-761.75 may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

ARAR Determination

Substantive provisions of 40 CFR §§ 761.65-761.75 may be relevant and appropriate as an action-specific ARAR for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of 40 CFR §§ 761.65-761.75 may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

2.3.2 Federal--Clean Air Act Regulations, 40 CFR Parts 52, 60, 61 and 63

In Clean Air Act (CAA) Regulations:

Summary

- Part 52 provides the federal regulations that govern the approval and promulgation of state implementation plans.

- Part 60 provides the federal standards that govern performance for new stationary sources.
- Part 61 provides National Emission Standards for Hazardous Air Pollutants (NESHAP) for a variety of chemicals; and Part 63 provides NESHAPs for additional chemicals.

Analysis

- Substantive, non-procedural, non-permit related provisions of Parts 60, 61 and 63 may be relevant and appropriate as action-specific ARARs for the on-site response, depending on the RAOs and technology chosen for cleanup of the site.
- Provisions of Parts 60, 61 and 63 may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.
- The Part 52 regulations are neither applicable nor relevant and appropriate because the approval and promulgation of state implementation plans bear no relationship to remediating Lower Ley Creek.
- The permit-related requirements of Parts 60, 61 and 63 are not applicable because these regulations are predicated on the CAA being directly controlling and on a CAA permit being required before any of the specified actions might lawfully proceed.

Other aspects of these regulations may be ARARs, depending on the circumstances, as described below.

ARAR Determination

Substantive provisions of Parts 60, 61 and 63 may be relevant and appropriate as an action-specific ARAR for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of Parts 60, 61 and 63 may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

2.3.3 Federal--Resource Conservation and Recovery Act Regulations, 40 CFR Part 257

Summary

Resource Conservation and Recovery Act (RCRA) Regulations, Part 257, Subpart A, sets forth the federal criteria for classification of solid waste disposal facilities and practice; and Subpart B provides disposal standards for the receipt of conditionally exempt small quantity generator (CESQG) wastes at non-municipal, non-hazardous waste disposal units.

Analysis

The regulations in Subpart B of Part 257 are neither applicable nor relevant and appropriate because CESQG wastes are not expected to be a subject of the on-site remediation of Lower Ley Creek. The permit-related requirements of Part 257, Subpart A, also are not applicable because these regulations are predicated on RCRA being directly controlling at this site and on a RCRA permit being required before any of the specified actions might lawfully proceed. However, it is solely CERCLA that controls at this site; other laws may pertain to this site only to the extent allowed by 42 USC §9621(d), and the NCP in 40 CFR §300.400(e) explicitly provides that permits are not required for on-site response actions under CERCLA. Therefore, all permit-related requirements of Part 257, Subpart A, are not applicable as action-specific ARARs for the on-site response actions.

Other aspects of these regulations may be ARARs, depending on the circumstances, as described below.

ARAR Determination

Substantive, non-procedural, non-permit related provisions of Part 257, Subpart A, may be relevant and appropriate as an action-specific ARAR for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of Part 257, Subpart A, may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

2.3.4 Federal RCRA, 40 CFR Parts 261, 262, and Subparts B, F, G, J, K, L, N, S, X of Part 264, 265, and 268 (with separate reference to 40 CFR § 262.11, 262.34, 264.13(b), and 264.232)

Summary

- Part 261 provides the federal regulations on the identification and listing of hazardous waste.
- Part 262 provides the federal standards for generators of hazardous waste.
- Part 264 sets forth the standards for owners and operators of hazardous waste treatment, storage and disposal facilities.
    - Subpart B provides general facility standards.
    - Subpart F concerns releases from solid waste management units.
    - Subpart G provides facility closure and post-closure procedures.
    - Subpart J provides the hazardous waste management procedures for tank systems.
    - Subpart K provides the hazardous waste management procedures for surface impoundments.
    - Subpart L provides the hazardous waste management procedures for waste piles.
    - Subpart N provides the hazardous waste management procedures for landfills.
    - Subpart S provides the corrective action procedures for solid waste management units.
    - Subpart X provides the hazardous waste management procedures for miscellaneous units.

- Part 265 sets forth the interim status standards for owners and operators of hazardous waste treatment, storage, and disposal facilities.
  - Subpart B provides general facility standards.
  - Subpart F concerns ground-water monitoring.
  - Subpart G provides facility closure and post-closure procedures.
  - Subpart J provides the hazardous waste management procedures for tank systems.
  - Subpart K provides the hazardous waste management procedures for surface impoundments.
  - Subpart L provides the hazardous waste management procedures for waste piles.
  - Subpart N provides the hazardous waste management procedures for landfills.
  - Note that there are no Subparts S or X in Part 265 as suggested in the RI.
- Part 268 sets forth the federal land disposal restrictions (LDR) for hazardous wastes, and Subpart C provides the more specific prohibitions on hazardous waste land disposal.

Analysis

Substantive, non-procedural, non-permit related provisions of Part 261, 262, 264, 265, and 268 may be relevant and appropriate as an action-specific ARAR for the on-site response, depending on the RAOs and technology chosen for cleanup of the site.

Provisions of Part 261, 262, 264, 265, and 268 may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

The permit-related requirements of Part 261, 262, 264, 265, and 268 are not applicable because these regulations are predicated on RCRA being directly controlling at this site and on a RCRA permit being required before any of the specified actions might lawfully proceed.

Other aspects of these regulations may be ARARs, depending on the circumstances, as described below.

ARAR Determination

Substantive provisions of Part 261, 262, 264, 265, and 268 may be relevant and appropriate as an action-specific ARAR for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of Part 261, 262, 264, 265 and 268 may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

2.3.5 Federal RCRA, 62 Federal Register 25997 (May 12, 1997)

Summary

The May 12, 1997, *Federal Register* notice published at 62 Federal Register 25997 primarily contains EPA's decision not to finalize the proposed Phase IV land disposal restriction provisions, but it does include some changes to the definition of solid waste for mineral processing materials that could impact the land disposal of mineral processing wastes.

Analysis

This final rulemaking is neither applicable nor relevant and appropriate because the land disposal of mineral processing wastes does not appear to be relevant to the remediation of Lower Ley Creek.

ARAR Determination

This final rule is not an action-specific ARAR or TBC for the Lower Ley Creek remediation.

2.3.6 Federal--CWA Regulations, 33 CFR Parts 320 – 330 and 40 CFR Part 230 and 231

Summary

In 33 CFR:

- Part 320 establishes the USACE's general regulatory policies.
- Part 321 establishes requirements for permits for dams and dikes in navigable waters of the United States.
- Part 322 establishes requirements for permits for structures or work in or affecting navigable waters of the United States.
- Part 323 provides definitions that pertain to the CWA Section 404 program for discharges of dredged or fill material and specifies the activities that do not require permits.
- Part 324 establishes requirements for permits for ocean dumping of dredged materials.
- Part 325 establishes requirements for the processing of USACE permits.
- Part 326 establishes requirements for enforcement of wetland dredge and fill permits.
- Part 327 establishes requirements for hearings on wetland dredge and fill permits.
- Part 328 establishes the definition of waters of the United States.
- Part 329 establishes the definition of navigable waters of the United States.
- Part 330 establishes the nationwide permit program.

In Title 40 of the CFR:

- Part 230 sets forth the CWA Section 404(b)(1) guidelines for specification of disposal sites for dredged or fill material, and implements 33 USC § 1344 for the review of proposed discharges of dredged or fill material into navigable waters.
- Part 231 sets forth the CWA Section 404(c) requirements for EPA's procedures prohibiting or withdrawing the specification, or denying, restricting, or withdrawing the use for specification of any defined area as a disposal site for dredged or fill material.

Analysis

- Substantive aspects of the statement of regulatory policy in 33 CFR 320 and the guidelines in 40 CFR Part 230 may be relevant and appropriate action-specific requirements depending on the RAA.
- Part 324 is not an action-specific ARAR because this site is not located on an ocean.
- Parts 231 and 325 are not action-specific ARARs because they are procedural in nature.
- Parts 326 and 327 are not action-specific ARARs because they only relate to enforcement or hearing procedures.
- While not applicable, the regulatory definitions or exclusions from CWA dredge and fill regulations in Parts 323, 328, 329 and 330 may be relevant and appropriate action-specific requirements depending on the RAA.
- Parts 321 and 322 are not applicable action-specific ARARs at this CERCLA site because these regulations are predicated on the CWA regulations being directly controlling and on a CWA permit being required before any of the specified actions might lawfully proceed. However, it is solely CERCLA that controls actions at this site; other laws may pertain to this site only to the extent allowed by 42 USC § 9621(d), and the NCP in 40 CFR § 300.400(e) explicitly provides that permits are not required for on-site response actions under CERCLA. Therefore, all permit-related requirements of Parts 321 and 322 are not applicable as action-specific ARARs the on-site response actions.

There are no promulgated regulations regarding the design and construction of the sediment consolidation area (SCA). Nonetheless, portions of CWA that regulate the discharge of dredge material could impact the design of the SCA. For example, section 230.10(b)(1), which prohibits the disposal of dredged material that violates water quality standards, after consideration of disposal site dilution and dispersion, would apply to the effluent or runoff discharged from the SCA. Section 230.10(c)(1) requires consideration of effects on municipal water supplies. Section 230.11 requires consideration of a broad range of possible effects from proposed dredged material discharges.

The USACE and EPA have jointly prepared a guidance document for management of contaminated dredged material (EPA/USACE [1992]) *Evaluating Environmental Effects of Dredged Material Management Alternatives – A Technical Framework.* EPA 8420B-92-008, Office of Water, Washington, D.C. Notably, this guidance document specifies that when contaminated dredged material is placed in confined disposal facilities, an analysis of pathways of concern must be completed to determine if treatment or site control measures (such as liners, caps, groundwater pumping, or leachate control systems) are required. This guidance, as well as other guidance documents, such as USACE (2003) are considered TBCs for the SCA.

ARAR Determination

Substantive provisions of Parts 321 and 322 may be relevant and appropriate as action-specific ARARs for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of Parts 321-323, 329-330 may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

In addition, the following are recommended as TBCs:

- USACE, Notice on Issuance of Nationwide Permits, 67 Federal Register 2020 (January 15, 2002).
- Letter from William R. Adriance, Chief Permit Administrator, to Richard Tomer and Paul G. Leuchner, Chiefs of the New York and Buffalo Districts of USACE, re. *Section 401 Water Quality Certification*, January 15, 2002 Nationwide Permits (Mar. 15, 2002).

2.3.7 Federal--Clean Water Act Regulations, 40 CFR Parts 121, 122, 125, 401 and 403.5

Summary

- Part 121 establishes state certification procedures for requiring a federal license or permit under the CWA.
- Part 122 implements the NPDES permits.
- Part 125 establishes criteria and standards for the NPDES system.
- Part 401 establishes effluent guidelines and standards.
- Section 403.5 establishes national pretreatment standards and prohibited discharges within the NPDES system.

Analysis

- Substantive, non-procedural, non-permit related provisions of Parts 121, 122, 125, 401 and Section 403.5 may be relevant and appropriate as an action-specific ARAR for the on-site response, depending on the RAOs and technology chosen for cleanup of the site.
- Provisions of Parts 121, 122, 125, 401 and Section 403.5 may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the RAOs and technology chosen for cleanup of the site.
- The permit-related requirements of Parts 121, 122, 125, 401 and Section 403.5 are not applicable because these regulations are predicated on the CWA NPDES requirements being directly controlling at this site and on a CWA NPDES permit being required before any of the specified actions might lawfully proceed.
- Other aspects of these regulations may be ARARs, depending on the circumstances, as described below.

ARAR Determination

Substantive provisions of Parts 121, 122, 125, 401 and Section 403.5 may be relevant and appropriate as an action-specific ARAR for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of Parts 121, 122, 125, 401 and Section 403.5 may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the RAOs and technology chosen for cleanup of the site.

2.3.8 Federal--Safe Drinking Water Act Regulations, 40 CFR Parts 144 -147

Summary

Part 144 establishes the SDWA underground injection control program; Part 145 establishes the state underground injection control program; Part 146 establishes the underground injection control program criteria and standards; and Part 147 sets forth the applicable underground injection control program in each state.

Analysis

These regulations are neither applicable nor relevant and appropriate for the cleanup of Lower Ley Creek, because the underground injection control regulations are predicated on protecting groundwater that is used or may potentially be used as a public drinking water supply. The groundwater adjacent to Lower Ley Creek is not used for any potable purpose and there are no plans for potable use in the future. Of equal significance, none of the remedies being evaluated for the on-site remediation of Lower Ley Creek are expected to involve the underground injection of wastes, sediments, materials or waters.

ARAR Determination

The SDWA regulations in 40 CFR Parts 144-147 are not action-specific ARARs for the Lower Ley Creek remediation.

2.3.9 Federal--U.S. Department of Transportation Regulations, 40 CFR Parts 170 et. seq.

Summary

Part 170 provides the U.S. Department of Transportation (DOT) procedures for carrying out DOT's duties under the Hazardous Materials Transportation Act (HMTA). Part 171 provides general information, regulations and definitions in connection with the DOT HMTA.

Analysis

Substantive, non-procedural, non-permit related provisions of DOT's HMTA regulations may be relevant and appropriate as an action-specific ARAR for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of DOT's HMTA regulations may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

The permit-related requirements of DOT's HMTA regulations are not applicable on-site because these regulations are predicated on the DOT's HMTA regulations being directly controlling at this site and on a DOT HMTA manifest being required before any of the specified actions might lawfully proceed. Other aspects of these regulations may be ARARs, depending on the circumstances, as described below.

ARAR Determination

Substantive provisions of DOT's HMTA regulations may be relevant and appropriate as an action-specific ARAR for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of DOT's HMTA regulations may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

2.3.10 State--New York Regulations, 6 NYCRR Part 360

Summary

Part 360 provides New York's general provisions for the regulation of solid waste management facilities. The Part 360 regulations also regulate the beneficial use of material that would normally be regulated as a "solid waste."

Analysis

Some aspects of these regulations may be relevant and appropriate depending on the circumstances. The permit-related requirements of Part 360 are not applicable on-site because these regulations are predicated on the New York's solid waste management facility regulations being directly controlling and on a New York solid waste management facility permit being required before any of the specified actions might lawfully proceed. As described above in Subsection 2.3.6 (Federal--CWA Regulations, 33 CFR Parts 320-330 and 40 CFR Parts 230 and 231), design and construction of an on-site SCA.

As described above in Section 2.3.6 (Federal--CWA Regulations, 33 CFR Parts 320-330 and 40 CFR Parts 230 and 231), design and construction of an on-site SCA would comply with applicable or relevant and appropriate portions of the CWA and its implementing regulations, along with guidance issued by the EPA and USACE. Thus, design and construction of the SCA would provide protection to the same human populations and environmental endpoints as would a solid waste facility designed under 6 NYCRR Part 360. Unlike the solid waste regulations prepared for facilities that handle a wide range of municipal and industrial solid wastes, the CWA regulations and guidance documents were prepared specifically for management of contaminated dredged materials.

In situations where there are competing applicable or relevant and appropriate requirements, the best approach is to select those ARARs that are most germane to the remedial alternative under consideration. In the case of the SCA, the CWA regulations and EPA and USACE guidance documents are the most relevant. They were specifically designed for management of contaminated dredged material and include a system of laboratory tests, analytical methods and design criteria that would provide protection to human health and the environment.

ARAR Determination

Substantive provisions of 6 NYCRR Part 360 may be relevant and appropriate as action-specific ARARs for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of 6 NYCRR Part 360 may be applicable or relevant and appropriate as action-specific ARAR for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

2.3.11 State--New York Regulations, 6 NYCRR Parts 361, 364, 370-376

Summary

- Part 361 provides the New York regulations for the siting of industrial hazardous waste facilities.
- Part 364 provides New York's waste transporter permits regulations.
- Part 370 provides the New York general hazardous management system regulations.
- Part 371 provides New York's regulations for the identification and listing of hazardous wastes.
- Part 372 provides the New York hazardous waste manifest system regulations and related standards for generators, transporters and facilities.
- Part 373 provides the New York interim status standards for owners and operators of hazardous waste facilities.
- Part 375 provides the New York inactive hazardous waste disposal sites regulations, manifest system regulations, and related standards for generators, transporters and facilities.
- Part 376 provides the New York land disposal restrictions regulations.

Analysis

Substantive, non-procedural, non-permit related provisions of 6 NYCRR Parts 361, 364, 370-376 may be relevant and appropriate as action-specific ARARs for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of 6 NYCRR Parts 361, 364, 370-376 may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

The permit-related requirements of Parts 361, 364, 370-376 are not applicable because these regulations are predicated on the New York's hazardous waste regulations being directly controlling and on a New York hazardous waste permit being required before any of the specified actions might lawfully proceed. Other aspects of these regulations may be ARARs, depending on the circumstances, as described below.

ARAR Determination

Substantive provisions of 6 NYCRR Parts 361, 364, 370-376 may be relevant and appropriate as action-specific ARARs for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of 6 NYCRR Parts 361, 364, 370-376 may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

2.3.12 State--New York Regulations, 6 NYCRR Parts 200, 202, 205, 207, 211, 212, 219 and 257

Summary

- Part 200 provides the general provisions of the state's air resources regulations.
- Part 202 provides the state regulations for air emissions verification.
- Part 205 provides the state architectural surface coatings regulations.
- Part 207 provides the state regulatory control measures for air pollution episodes.
- Part 211 provides the general state prohibitions.
- Part 212 provides the general process emission sources regulations.
- Part 219 provides the state's incinerator regulations.
- Part 257 provides specific state air quality standards.

Analysis

Substantive, non-procedural, non-permit related provisions of 6 NYCRR Parts 200, 202, 205, 207, 211, 212, 219 and 257 may be relevant and appropriate as action-specific ARARs for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of 6 NYCRR Parts 200, 202, 205, 207, 211, 212, 219 and 257 may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

The permit-related requirements of Parts 200, 202, 205, 207, 211, 212, 219 and 257 are not applicable here because these regulations are predicated on the New York's air resources regulations being directly controlling and on a New York air emissions permit being required before any of the specified actions might lawfully proceed. Other aspects of these regulations may be ARARs, depending on the circumstances, as described below.

ARAR Determination

Substantive provisions of 6 NYCRR Parts 200, 202, 205, 207, 211, 212, 219 and 257 may be relevant and appropriate as action-specific ARARs for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of 6 NYCRR Parts 200, 202, 205, 207, 211, 212, 219 and 257 may be applicable or relevant and appropriate as action-specific ARAR for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

2.3.13 State--New York Regulations, 6 NYCRR Part 608

Summary

Part 608 provides the New York regulations for the use and protection of state waters.

Analysis

Substantive, non-procedural, non-permit related provisions of 6 NYCRR Part 608 may be relevant and appropriate as action-specific ARARs for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of 6 NYCRR Part 608 may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

The permit-related requirements of Part 608 are not applicable here because these regulations are predicated on the New York's water use and protection regulations being directly controlling and on a New York water use permit being required before any of the specified actions might lawfully proceed. Other aspects of these regulations may be ARARs, depending on the circumstances, as described below.

As noted above in the chemical-specific ARAR section, dredged or fill material and dredge return water discharged into waters of the state are generally exempt from SPDES permit requirements. Therefore, the most relevant and appropriate regulations to govern the discharge of treated supernatant water from the SCA after dredging are state and federal CWA Section 404 regulations. The following paragraphs described how this discharge would be regulated under these regulations.

For non-CERCLA sites, dredge return water is regulated under Section 404 of the Clean Water Act and does not require and SPDES permit [6 NYCRR § 750-1.5(a)(7): *see Final Revisions to the Clean Water Act Regulatory Definitions of "Fill Material" and "Discharge of Fill Material", 67 Federal Register 31129, 31135 (May 9, 2002)*]. Dredged material is defined as "material that is excavated or dredged from water of the United States." *33 CFR 323.2(c)*. Because the water from the SCA would be dredged from Lower Ley Creek falls within the definition of dredge material, it should be treated as such. The USACE, to which authority over dredge and fill discharge permits has been delegated under the Clean Water Act, has stated that return water is regulated as a discharge of dredged material.

The substantive requirements of 33 CFR Parts 320 and 323 and 40 CFR Part 230 would apply to the return water discharge. These requirements may be met by showing that (a) the proposed discharge would fall within the substantive requirements for obtaining a general nationwide permit for dredging, or (b) the substantive standards applied to individual dredging permits would be achieved. Additionally, the water discharge would need to meet the substantive water quality requirements imposed by New York State or entities seeking a dredged material discharge permit under Section 404 of the CWA. Thus, an applicant for a water quality certification must demonstrate that the discharge would meet applicable effluent limits and water quality standards in 6 NYCRR 608.

As specified in the federal regulations, discharge of dredged material will only be *prohibited "if after consideration of disposal site dilution and dispersion, it causes or contributes to the violation of any applicable state water quality standard or violates any applicable toxic effluent limit." 40 CFR § 230.10(b).* Moreover, the regulations state that a discharge of dredged material will not be permitted only if there is a practical alternative that would have less adverse environmental impact (40 CFR § 230.10(a)). Here the term "practicable" is defined as *"available and capable of being done after taking into account cost, existing technology, and logistics in light of overall project purposes." 40 CFR § 230.3.* Also, any discharge of dredged materials must not cause or contribute to significant degradation of the waters of the United States (40 CFR § 230.10(c)). An evaluation of significant degradation would be based on a number of determinations and evaluations including the following:

- Impacts on the physical and chemical characteristics of the aquatic ecosystem;
- Impacts on the biological characteristics of the ecosystem;
- Impacts on wildlife refuges, wetlands, and mudflats and other sensitive areas; and
- Impacts on human use of the water system.

The USACE has issued two nationwide permits that may be ARARs. Nationwide Permit 38 applies to "*specific activities required to effect the containment, stabilization, or removal of hazardous or toxic waste materials that are performed, ordered, or sponsored by a government agency with established legal or regulatory authority…[as well as] court ordered remedial action plans or related settlements.*" *Department of the Army, Corps of Engineers, Issuance of Nationwide Permits: Notice 67 Federal Register 2019, 2085 (Jan. 15, 2002).* Because New York State has issued a statewide water quality certification for discharges that qualify for this nationwide permit, water quality certification is presumptive. Nationwide Permit 16 covers discharges of return water from upland contained disposal areas, irrespective of the purpose for which dredging was undertaken [*Department of the Army, Corps of Engineers. Issuance of Nationwide Permits: Notice, 67 Federal Register 2019, 2081 (Jan. 15, 2002)*]. A discharge that meets the requirements for this nationwide permit must still meet the substantive state water quality certification standards, but may do so after consideration of site dilution and dispersion in accordance with 40 CFR § 230.10(b).

Additionally, state regulations pertaining to dredging projects may be ARARs. 6 NYCRR Section 608.8 provides the basis for issuance of a State dredge or fill permit. That provision states that a permit should be issued if the project is (a) reasonable and necessary; (b) will not endanger the health, safety, or welfare of the people of New York; and (c) will not cause unreasonable, uncontrolled, or unnecessary damage to natural resources of the state. Discharge of supernatant water will not have substantial adverse impact on water quality outside the work area. It likely will not result in significant additional exceedances of water quality standards beyond those already resulting from dredging within the work area. Section 608.9 requires that any dredging project obtain state certification that it meets water quality standards and effluent limits under Section 401 of the CWA. However, Section 608.9 does not require that such standards be met at the point of discharge and does not contradict the mandates of the federal regulations that disposal site dilution and dispersion be taken into account.

ARAR Determination

Substantive provisions of 6 NYCRR Part 608 may be relevant and appropriate as action-specific ARARs for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of 6 NYCRR Part 608 may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

2.3.14 State--New York Regulations, 6 NYCRR Parts 700-706

Summary

- The regulations in Parts 700-706 include water quality classifications, standards and guidance values.
- Part 700 provides definitions and describes collection and sampling procedures.
- Part 701 establishes classifications for surface waters and groundwater.
- Part 702 establishes the deviation and use of these standards and guidance values.
- Part 703 establishes surface water and groundwater quality standards and groundwater effluent limitations.
- Part 704 establishes criteria for thermal discharges.
- Part 705 contains references.
- Part 706 establishes additional procedures for the derivation of standards and guidance values that are protective of aquatic life from acute and chronic effects.

Analysis

- Parts 700 and 705 are not applicable or relevant and appropriate because they are administrative or procedural in nature.
- In Part 701, the descriptions of the classifications assigned to waters of the State, including the classifications assigned to the creek, as well as a general prohibition on any discharge that impairs the receiving water for its assigned best usages are relevant and appropriate ARARs.
- Part 702 includes procedures used for deriving water quality standards and guidance values which are not applicable or relevant and appropriate because they are administrative or procedural in nature.
- Part 703 includes general and chemical-specific water quality standards and is relevant and appropriate.
- Part 704 would not be relevant and appropriate to alternatives involving dredging, dewatering and discharge to the creek because no thermal discharges are otherwise anticipated as a result of the cleanup of the site.
- Part 706 includes procedures for developing water quality standards and guidance values to protect aquatic life, which are not applicable or relevant and appropriate because they are administrative or procedural in nature.
- Parts 700-706 are not applicable ARARs because all the necessary jurisdictional requirements are not met in the context of potential on-site response actions.

ARAR Determination

Substantive provisions of Parts 703 and 704 are potential relevant and appropriate action-specific ARARs for the on-site response.

2.3.15 State--New York, 6 NYCRR Parts 750-758

Summary

- Part 750 provides general regulatory provisions for the SPDES.
- Part 751 specifies the required SPDES permits.
- Part 752 provides SPDES permit application and data requirements.
- Part 753 provides notice and public participation requirements for SPDES permits.
- Part 754 specifies required provisions for SPDES permits.
- Part 755 provides requirements for the duration and reissuance of SPDES permits.
- Part 756 provides the monitoring, recording and reporting requirements for SPDES permits and schedules for compliance.
- Part 757 provides the process for modification, suspension and revocation of SPDES permits and schedules for compliance.
- Part 758 provides supporting references.

Analysis

Substantive, non-procedural, non-permit related provisions of 6 NYCRR Parts 750-758 may be relevant and appropriate as action-specific ARARs for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of 6 NYCRR Parts 750-758 may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

The permit-related requirements of Parts 750-758 are not applicable because these regulations are predicated on the New York SPDES regulations being directly controlling and on a New York SPDES permit being required before any of the specified actions might lawfully proceed. Other aspects of these regulations may be ARARs, depending on the circumstances, as described below.

ARAR Determination

Substantive provisions of 6 NYCRR Parts 750-758 may be relevant and appropriate as action-specific ARARs for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of 6 NYCRR Parts 750-758 may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

2.3.16 State--New York State Environmental Conservation Law, Article 17, Title 5

Summary

Environmental Conservation Law (ECL) Title 5 consists of:

- Section 17-0501, the general prohibition against pollution;
- Section 17-0503, the prohibition against pollution of waters of a marine district;
- Section17-0505, the prohibition against certain acts without permit;
- Section 17-0507, the prohibition against modification of wastes discharged through an existing outlet or point source without permit;
- Section 17-0509, minimum treatment required; and
- Section 17-0511, restrictions on discharge of sewage, industrial waste or other waste.

Analysis

Substantive, non-procedural, non-permit related provisions of Sections 17-0501, 17-0503, 17-0505, 17-507, 17-0509 and 17-0511 may be relevant and appropriate as action-specific ARARs for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of Sections 17-0501, 17-0503, 17-0505, 17-507, 17-0509 and 17-0511 may be applicable or relevant and appropriate as action-specific ARAR for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

The permit-related requirements of Sections 17-0501, 17-0503, 17-0505, 17-507, 17-0509 and 17-0511 are not applicable here because these statutes are predicated on the New York ECL being directly controlling and on a New York ECL permit being required before any of the specified actions might lawfully proceed. Other aspects of these statutes may be ARARs, depending on the circumstances, as described below.

ARAR Determination

Substantive provisions of Sections 17-0501, 17-0503, 17-0505, 17-507, 17-0509 and 17-0511 may be relevant and appropriate as action-specific ARARs for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of Sections 17-0501, 17-0503, 17-0505, 17-507, 17-0509 and 17-0511 may be applicable or relevant and appropriate as action-specific ARAR for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

2.3.17 State--New York State Environmental Conservation Law § 11-0503

Summary

Section 11-0503 prohibits the polluting of streams by certain substances in quantities that are injurious to fish and protected wildlife and waterfowl.

Analysis

Substantive, non-procedural, non-permit related provisions of Section 11-0503 may be relevant and appropriate as action-specific ARARs for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of Section 11-0503 may be applicable or relevant and appropriate as action-specific ARARs for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

This statute is predicated on the New York ECL being directly controlling. However, it is solely CERCLA that controls actions at this site; other laws may pertain to this site only to the extent allowed by 42 USC §9621(d). Therefore, the requirements of Section 11-0503 are not applicable as an action-specific ARAR for the on-site response actions. Other aspects of this statute may be ARARs, depending on the circumstances, as described below.

ARAR Determination

Substantive provisions of Section 11-0503 may be relevant and appropriate as action-specific ARARs for the on-site response, depending on the RAOs and technology chosen for cleanup of the site. Provisions of Section 11-0503 may be applicable or relevant and appropriate as action-specific ARAR for any off-site response that may occur as part of remediation of the site, depending on the technologies chosen for cleanup of the site.

2.3.18 Local-Local County or Municipal Pretreatment Requirements, Local Regulations

Summary

If water from remedial cleanup work was sent to a publicly-owned water treatment facility, County or municipal pretreatment regulations would apply.

Analysis

CERCLA, the NCP, and EPA guidance do not allow for consideration of local regulations as an ARAR for the on-site cleanup of a CERCLA site. Therefore, County or municipal pretreatment regulations and other local regulations are not an action-specific ARAR for purposes of the Lower Ley Creek remediation. However, provisions of county or municipal pretreatment regulations and other local regulations may apply, according to their own terms, to the off-site transport, final disposal or treatment of remediation wastes from the site.

ARAR Determination

County or municipal pretreatment regulations and other local regulations are not an action-specific ARAR for purposes of the Lower Ley Creek remediation.

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TABLES

Table A-1
Chemical-Specific Potential Applicable or Relevant and Appropriate Requirements

Medium/Authority	Citation	Status for FS	Requirement Synopsis
WATER			
Clean Water Act 40 [Federal Water Pollution Control Act; as amended], 33 USC §§ 1251-1387	40 CFR Part 129	Part 129 is a potential relevant and appropriate chemical-specific ARAR for purposes of on-site response.	Toxic Pollutant Effluent Standards for aldrin/dieldrin, DDT, endrin, toxaphene, benzidene and PCBs.
Safe Drinking Water Act, 42 USC §§ 300f -300j-26	40 CFR Part 141	Part 141 is a potential relevant and appropriate chemical-specific ARAR for purposes of on-site response.	National Primary Drinking Water Regulations
New York State ECL Article 15, Title 3 and Article 17, Titles 3 and 8			Part 608 includes the requirement to obtain a SPDES permit for certain discharges in any navigable waters of the State (6 NYCRR 608.5). The regulations contained in 6 NYCRR Parts 700 – 706 include water quality classifications, standards and guidance values.
	6 NYCRR Part 608	Relevant and appropriate are Section 608.6(a) and 608.9(a).	Note that: • Section 608.6(a) requires development and submission of a sufficiently detailed construction plan with a map); • Section 608.9(a) requires that construction or operation of facilities that may result in a discharge to navigable waters demonstrate compliance with CWA §§ 301 – 303, 306 and 307 and 6 NYCRR §§ 751.2 (prohibited discharges) and 754.1 (effluent prohibitions; effluent limitations and water quality-related effluent limitations; pretreatment standards; standards of performance for new sources.)
	6 NYCRR Part 700	Part 700 is not applicable or relevant and appropriate because it is administrative or procedural in nature.	Part 700 provides definitions and describes collection and sampling procedures.

Table A-1
Chemical-Specific Potential Applicable or Relevant and Appropriate Requirements

Medium/Authority	Citation	Status for FS	Requirement Synopsis
New York State ECL Article 15, Title 3 and Article 17, Titles 3 and 8 (continued)	6 NYCRR Part 701	Part 701 classifications of waters of the State as well as a general prohibition on any discharge that impairs the receiving water for its assigned best usages are relevant and appropriate.	Part 701 establishes classifications for surface waters and groundwater.
	6 NYCRR Part 702	Part 702 procedures for deriving water quality standards and guidance values are not applicable or relevant and appropriate because they are administrative or procedural in nature.	Part 702 establishes the deviation and use of these standards and guidance values.
	6 NYCRR Part 703	Part 703 includes general and chemical-specific water quality standards that are relevant and appropriate.	Part 703 establishes surface water and groundwater quality standards and groundwater effluent limitations.
	6 NYCRR Part 704	Part 704 potentially only be relevant and appropriate to alternatives involving dredging, dewatering at elevated temperatures and discharge to the creek at elevated	Part 704 establishes criteria for thermal discharges.
	6 NYCRR Part 705	Part 705 is are not applicable or relevant and appropriate because it is administrative or procedural in nature.	Part 705 contains reference sources for related regulations.
	6 NYCRR Part 706	Part 706 procedures for developing water quality standards and guidance values are not applicable or relevant and appropriate because they are administrative or procedural in nature.	Part 706 establishes additional procedures for the derivation of standards and guidance values that are protective of aquatic life from acute and chronic effects.

Table A-1
Chemical-Specific Potential Applicable or Relevant and Appropriate Requirements

Medium/Authority	Citation	Status for FS	Requirement Synopsis
AIR			
No promulgated chemical-specific ARARs identified for air.			
SEDIMENT			
No promulgated chemical-specific ARARs identified for sediment.			
BIOTA			
No promulgated chemical-specific ARARs identified for fish (biota). The FDA limits (e.g., 1 ppm mercury, 2 ppm PCBs) are not based on federal or state environmental law.			

Notes:

ARAR = Applicable or Relevant and Appropriate Requirements

CFR = Code of Federal Regulations

CWA = Clean Water Act

ECL = Environmental Conservation Law

DDT = dichlorodiphenyltrichloroethane

FDA = Food and Drug Administration

NYCRR = New York Codes, Rules, and Regulations

PCB = polychlorinated biphenyl

ppm = parts per million

SPDES = State Pollution Discharge Elimination System

Table A-2
Chemical-Specific Potential Criteria, Advisories and Guidance
To Be Considered

Medium/Authority	Citation	Status for FS	Requirement Synopsis
BIOTA			
International Joint Commission – United States and Canada	Great Lakes Water Quality Agreement of 1978, as amended	TBC	The concentration of total PCBs in fish tissue (whole fish, wet weight basis) should not exceed 0.1 µg/g for the protection of birds and animals that consume fish. Criterion for mercury is 0.5 µg/g mercury in whole fish [wet weight basis].
NOAA – Damage Assessment Center	Reproductive, Developmental and Immunotoxic Effects of PCBs in Fish: A Summary of Laboratory and Field Studies, March 1999 (Monosson, E.)	TBC	The effective concentrations for reproductive and developmental toxicity fall within the ranges of the PCB concentrations found in some of the most contaminated fish. There are currently an insufficient number of studies to estimate the immunotoxicity of PCBs in fish. Improper functioning of the reproductive system and adverse effects on development may result from adult fish liver concentrations of 25 to 71 ppm Aroclor 1254. PCB Congener BZ #77: 0.3 to 5 ppm (wet wt) in adult fish livers reduces egg deposition, pituitary gonadotropin, and gonadosomatic index, alters retinoid concentration (Vitamin A), and reduces larval survival. 1.3 ppm in eggs reduces larval survival.
DEC Division of Fish and Wildlife	Niagara River Biota Contamination Project: Fish Flesh Criteria for Piscivorous Wildlife, Technical Report 87-3, July 1987, pp. 41-48 and Table 26 (Newell *et al.*)	TBC	Provides a method for calculating concentrations of organochlorines in fish flesh for the protection of wildlife. The fish flesh criterion is 0.11 mg/kg wet wt for PCBs, 3 mg/kg for dioxin/furans, and 0.33 mg/kg for hexachlorobenzene.
SEDIMENT			
EPA Office of Emergency and Remedial Response	Guidance on Remedial Actions for Superfund Sites with PCB Contamination, EP A/540/G- 90/007, August 1990 (OSWER Dir. No. 9355.4-01).	TBC	Provides guidance in the investigation and remedy selection process for PCB-contaminated Superfund sites. Provides preliminary remediation goals for various contaminated media, including sediment (pp. 34-36) and identifies other considerations important to protection of human health and the environment.
NOAA – Damage Assessment Office	Development and Evaluation of Consensus-Based Sediment Effect	TBC	Estuarine, freshwater and saltwater sediment effects concentrations for total PCBs: Threshold Effect Concentration: 0.04 mg/kg
	Concentrations for PCBs in the Hudson River, MacDonald Environmental Services Ltd., March 1999		Mid-range Effect Concentration: 0.4 mg/kg Extreme Effect Concentration: 1.7 mg/kg

Table A-2
Chemical-Specific Potential Criteria, Advisories and Guidance To Be Considered

Medium/Authority	Citation	Status for FS	Requirement Synopsis
NOAA (compilation of other literature sources for SQGs)	SQRTs for Organics	TBC	Tables with screening concentrations for inorganic and organic contaminants.
EPA Great Lakes National Program Office, ARCS Program	Calculation and Evaluation of Sediment Effect Concentrations for the Amphipod Hyalella azteca and the midge Chironomus riparius, EPA 905-R96-008, September 1996	TBC	Provides SECs, which are defined as the concentrations of a contaminant in sediment below which toxicity is rarely observed and above which toxicity is frequently observed.
DEC Division of Fish, Wildlife and Marine Resources	Technical Guidance for Screening Contaminated Sediment, January 1999	TBC	Includes a methodology to establish sediment criteria for the purpose of identifying contaminated sediments. Provides sediment quality screening values for non-polar organic compounds, such as PCBs, and metals to determine whether sediments are contaminated (above screening criteria) or clean (below screening criteria). Screening values are not cleanup goals. Also discusses the use of sediment criteria in risk management decisions.
SOIL			
DEC-Division of Environmental Remediation	Technical Administrative Guidance Memorandum No. 94- Remediation HWR-4046	TBC	Recommended Soil Cleanup Objectives

Table A-2
Chemical-Specific Potential Criteria, Advisories and Guidance
To Be Considered

Medium/Authority	Citation	Status for FS	Requirement Synopsis
WATER			
International Joint Commission – United States and Canada	Great Lakes Water Quality Agreement of 1978, as amended	TBC	The concentration of total PCBs in fish tissue (whole fish, wet weight basis) should not exceed 0.1 µg/g for the protection of birds and animals that consume fish. Criterion for mercury is 0.5 µg/g mercury in whole fish [wet weight basis].
EPA	EPA Safe Drinking Water Act	TBC	MCLs
EPA	EPA Federal Register, Volume 57, No. 246, December 22, 1992	TBC	Ambient Water Quality Criteria
DEC	DEC TOGS 1.1.2	TBC	New York State Groundwater Effluent Limitations
AIR			
DEC	New York Air Cleanup Criteria, January 1990	TBC	Provides guidance for the control of ambient air contaminants in New York State.

Notes:

ARCS = Assessment and Remediation of Contminated Sediment

DEC = Department of Environmental Conservation

EPA = U.S. Environmental Protection Agency

MCL = maximum contaminant level

mg/kg = milligrams per kilogram

NOAA = National Oceanic and Atmospheric Administration

PCB = polychlorinated biphenyl

ppm = parts per million

SEC = sediment effect concentrations

SQG = Sediment Quality Guidelines

SQRT = Screening Quick Reference Table

TBC = To Be Considered

µg/g = micrograms per gram

Table A-3
Location-Specific Potential Applicabe or Relevant and Appropriate Requirements

Medium/ Authority	Citation	Status for FS	Requirement Synopsis
Fish and Wildlife Coordination Act	16 USC § 662	Substantive portions of Section 662 are potential relevant and appropriate location- specific ARAR for purposes of on-site response.	Whenever the waters of any stream or other body of water are proposed or authorized to be impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose, by any department or agency of the United States, such department or agency first shall consult with the United States Fish and Wildlife Service, Department of the Interior, and with the head of the agency exercising administration over the wildlife resources of the particular State in which the impoundment, diversion, or other control facility is to be constructed, with a view to the conservation of wildlife resources by preventing loss of and damage to such resources.
Endangered Species Act	16 USC §§ 1531 et. seq.	Substantive provisions in Sections 1538 is a potential applicable location-specific ARAR for on-site response. Substantive provisions in Sections 1539 is a potential relevant and appropriate location-specific ARAR for on-site response.	Federal statute establishing programmatic protection for endangered and threatened species.
Clean Water Act	33 CFR Parts 320-330	Substantive portions of Parts 320 – 330 are potential relevant and appropriate location-specific ARAR for purposes of on-site response.	Dredge and Fill in Wetlands

Table A-3
Location-Specific Potential Applicabe or Relevant and Appropriate Requirements

Medium/ Authority	Citation	Status for FS	Requirement Synopsis
Section 404 of the Clean Water Act [Federal Water Pollution Control Act, as amended], 33 USC § 1344	33 CFR Parts 320-329	Substantive portions of Parts 320 – 329 are potential relevant and appropriate location-specific ARAR for purposes of on-site response.	Includes requirements for issuing permits for the discharge of dredged or fill material into navigable waters of the United States. A permit is required for construction of any structure in a navigable water.
National Historic Preservation Act (NHPA), 16 USC § 470 et seq.	36 CFR Part 800	Substantive portions of Part 800 are a potential applicable location-specific ARAR for purposes of on-site response.	Proposed remedial actions must take into account effect on properties in or eligible for inclusion in the National Registry of Historic Places. Federal agencies undertaking a project having an effect on a listed or eligible property must provide the Advisory Council on Historic Preservation a reasonable opportunity to comment pursuant to section 106 of the NHPA of 1966, as amended. While the Advisory Council comments must be taken into account and integrated into the decision-making process, program decisions rest with the agency implementing the under-taking. A Stage 1A cultural resource survey is expected to be necessary for any active remediation to identify historic properties along the creek to determine if any areas should be the subject of further consideration under NHPA.
Fish and Wildlife Coordination Act	40 CFR § 6.302	Not an applicable or relevant and appropriate location-specific ARAR for purposes of on-site response.	Modification to Waterways that Affect Fish or Wildlife

Table A-3
Location-Specific Potential Applicabe or Relevant and Appropriate Requirements

Medium/ Authority	Citation	Status for FS	Requirement Synopsis
Procedures for Implementing the Requirements of the Council of Environmental Quality on the National Environmental Policy Act	40 CFR Part 6, Subpart A	Substantive portions of Subpart A are a potential relevant and appropriate location-specific ARAR for purposes of on-site response.	Sets forth EPA policy and guidance for implementing NEPA and related CEQ regulations.
Clean Water Act Section 401, 33 USC 1341	40 CFR Part 121	Substantive portions of Part 121 are potential relevant and appropriate location-specific ARAR for purposes of on-site response.	State Water Quality Certification Program
Clean Water Act	40 CFR Parts 122, 125 and 401	Substantive portions of Parts 121, 125 and 401 are potential relevant and appropriate location- specific ARAR for purposes of on-site response.	Wastewater Discharge Permits; Effluent Guidelines and Best Available Technology
Safe Drinking Water Act	40 CFR Parts 144-147	Parts 144 – 147 are not potential location-specific ARARs for on-site response.	Underground Injection Control Program

Table A-3
Location-Specific Potential Applicabe or Relevant and Appropriate Requirements

Medium/ Authority	Citation	Status for FS	Requirement Synopsis
Clean Water Act, Section 404, 33 USC § 1344	40 CFR Parts 230 and 231	Substantive portions of Parts 230 and 231 are potential relevant and appropriate location-specific ARAR for purposes of on-site response.	No activity which adversely affects an aquatic ecosystem, including wetlands, shall be permitted if a practicable alternative that has less adverse impact is available. If there is no other practical alternative, impacts must be minimized.
Clean Water Act	40 CFR § 403.5	Substantive portions of Section 403.5 are a potential relevant and appropriate location- specific ARAR for purposes of on-site response.	Discharge to Publicly-Owned Treatment Works
Toxic Substances Control Act (TSCA), Title 1,15 USC § 2601	40 CFR §§ 761.65 – 761.75	Substantive portions of Sections 761.65 – 761.75 are potential relevant and appropriate location-specific ARAR for purposes of on-site response.	TSCA facility requirements: Establishes siting guidance and criteria for storage (761.65), chemical waste landfills (761.75), and incinerators (761.70).
New York State ECL Article 11, Title 5	6 NYCRR Part 182	Substantive portions of 6 NYCRR §§ 182.3 and 182.6 are potential relevant and appropriate location-specific ARAR for purposes of on-site response.	The taking of any endangered or threatened species is prohibited, except under a permit or license issued by DEC. The destroying or degrading the habitat of a protected animal likely constitutes a "taking" of that animal under NY ECL § 11-0535.

Table A-3
Location-Specific Potential Applicabe or Relevant and Appropriate Requirements

Medium/ Authority	Citation	Status for FS	Requirement Synopsis
New York State ECL Article 3, Title 3; Article 27, Titles 7 and 9	6 NYCRR § 373-2.2	Substantive portions of 6 NYCRR § 373-2.2 are a potential relevant and appropriate location-specific ARAR for purposes of on-site response.	Establishes construction requirements for hazardous waste facilities in 100 year floodplain.
New York State ECL Article 15, Title 5, 6 NYCRR Part 608 Use and Protection of Waters	6 NYCRR Part 608	Substantive portions of 6 NYCRR Part 608 are a potential applicable location-specific ARAR for purposes of on-site response.	Protection of Waters Program
New York State Freshwater Wetlands Law, ECL Article 24, Title 7	6 NYCRR Parts 662-665	Substantive portions of Parts 662-664 are a potential relevant and appropriate location-specific ARAR for purposes of on-site response.	Defines procedural requirements for undertaking different activities in and adjacent to freshwater wetlands, and establishes standards governing the issuance of permits to alter or fill freshwater wetlands.

Notes:

ARAR = Applicable or Relevant and Appropriate Requirements

CEQ = Council on Environmental Quality

CFR = Code of Federal Regulations

CWA = Clean Water Act

DEC = Department of Environmental Conservation

ECL = Environmental Conservation Law

EPA = U.S. Environmental Protection Agency

NEPA = National Environmental Protection Act

NHPA = National Historic Preservation Act

NY = New York

NYCRR = New York Codes, Rules, and Regulations

TSCA = Toxic Substances Control Act

Table A-4
Location-Specific Potential Criteria, Advisories and Guidance
To Be Considered

Medium/Authority	Citation	Status for FS	Requirement Synopsis
EPA	Statement of Procedures on Floodplain, Management and Wetlands Protection, January 1979	TBC	Requires Federal agencies to evaluate the potential effects of actions it may take in a floodplain to avoid adversely impacting floodplains wherever possible and to ensure that its planning programs and budget requests reflect consideration of flood hazards and floodplain management.
EPA Office of Solid Waste and Emergency Response	Policy on Floodplains and Waste and Wetland Assessments for CERCLA Actions, August 1985	TBC	Superfund actions must meet the substantive requirements of the Floodplain Management Emergency Executive Order (E.O. 11988) and the Protection of Response 1985 Wetlands Executive Order (E.O. 11990) (see Table 9-3: Location-Specific ARARs). This memorandum discusses situations that require preparation of a floodplain or wetlands assessment and the factors that should be considered in preparing an assessment for response actions taken pursuant to Section 104 or 106 of CERCLA. For remedial actions, a floodplain/wetlands assessment must be incorporated into the analysis conducted during the planning of the remedial action.
Executive Order No. 11988, 42 Fed. Reg. 26951 (May 25, 1977)	Floodplain Management	TBC	Executive Order describes the circumstances where federal agencies should manage floodplains.
Executive Order No. 11990, 42 Fed. Reg. 26961 (May 25, 1977)	Protection of Wetlands	TBC	Executive Order describes the circumstances where federal agencies should manage wetlands.

Notes:
ARAR = Applicable or Relevant and Appropriate Requirement

CERLCA = Comprehensive Environmental Response, Compensation and Liability Act

E.O. = Executive Order

EPA = U.S. Environmental Protection Agency

TBC = To Be Considered

Table A-5
Action-Specific Potential Applicable or Relevant and Appropriate Requirements

Medium/Authority	Citation	Status for FS	Requirement Synopsis
Section 10, Rivers and Harbors Act, 33 USC § 403	33 CFR Parts 320 - 330	Substantive portions of 33 CFR Parts 321 - 322 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	U.S. Army Corps of Engineers approval is generally required to excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity of the channel of any navigable water of the United States.
Clean Air Act, 42 USC s/s 7401 et seq. (1970)	40 CFR Part 52	Not an action-specific ARAR for purposes of this on-site response.	Approval and Promulgation of Implementation Plans
Clean Air Act, 42 USC s/s 7401 et seq. (1970)	40 CFR Part 60	Substantive portions of 40 CFR Part 60 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Standards of Performance for New Stationary Sources
Clean Air Act, 42 USC s/s 7401 et seq. (1970)	40 CFR Parts 61 and 63	Substantive portions of 40 CFR Parts 61 and 63 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Part 61- National Emission Standards for Hazardous Air Pollutants. Part 63 - National Emission Standards for Hazardous Air Pollutants for Source Categories.
Section 402 of the Clean Water Act	40 CFR Parts 121, 122, 125, 401 and 403.5	Substantive portions of 40 CFR Parts 121, 122, 125, 401 and 403.5 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Provisions related to the implementation of the National Pollutant Discharge Elimination System (NPDES) program

Table A-5
Action-Specific Potential Applicable or Relevant and Appropriate Requirements

Medium/Authority	Citation	Status for FS	Requirement Synopsis
Safe Drinking Water Act	40 CFR Parts 144 - 147	Substantive portions of 40 CFR Parts 144 - 147 are not action-specific ARARs for purposes of on-site response.	SDWA underground injection control program
Section 404(b) of the Clean Water Act	40 CFR Part 230	Substantive portions of 40 CFR Part 230 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Guidelines for Specification of Disposal Sites for Dredged or Fill Material. Except as otherwise provided under Clean Water Act Section 404(b)(2), no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. Includes criteria for evaluating whether a particular discharge site may be specified.
Section 404(c) of the Clean Water Act, 33 USC § 1344(b)	33 CFR Parts 320, 323, 325, 329 and 330	Substantive portions of 33 CFR Parts 320, 323 325, 329 and 330 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	These regulations apply to all existing, proposed, or potential disposal sites for discharges of dredged or fill materials into U.S. waters, which include wetlands. Includes special policies, practices, and procedures to be followed by the U.S. Army Corps of Engineers in connection with the review of applications for permits to authorize the discharge of dredged or fill material into waters of the United States pursuant to Section 404 of the Clean Water Act.
Resource Conservation and Recovery Act	40 CFR Part 257	Substantive portions of 40 CFR Part 257 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Criteria for Classification of Waste Disposal Facilities

Table A-5
Action-Specific Potential Applicable or Relevant and Appropriate Requirements

Medium/Authority	Citation	Status for FS	Requirement Synopsis
Resource Conservation and Recovery Act 42 USC s/s 6901 et seq. (1976) Subtitle C – Wastes	40 CFR Part 261	Substantive portions of 40 CFR Parts 261 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Identification and listing of hazardous waste
Resource Conservation and Recovery Act 42 USC s/s 6901 et seq. (1976)	40 CFR Part 262	Substantive portions of 40 CFR Part 262 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Standards applicable to generators of hazardous waste
Resource Conservation and Recovery Act 42 USC s/s 6901 et seq. (1976)	40 CFR § 262.11	Substantive portions of 40 CFR § 262.11 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Hazardous waste determination
Resource Conservation and Recovery Act, 42 USC s/s 6901 et seq. (1976)	40 CFR Part 262.34	Substantive portions of 40 CFR § 262.34 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Standards for Hazardous Waste Generators, 90-Day Accumulation Rule

Table A-5
Action-Specific Potential Applicable or Relevant and Appropriate Requirements

Medium/Authority	Citation	Status for FS	Requirement Synopsis
Resource Conservation and Recovery Act, 42 USC s/s 6901 et seq. (1976)	40 CFR Part 264 and 265, Subparts B-264.10-.19 F-264.90-.101 G-264.110-.120 J-264.190-.200 S-264.550-.555 X-264.600-.603	Substantive portions of the referenced Subparts of Parts 264 and 265 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facilities. B- General Facility Standards F- Releases from Solid Waste Management Units G- Closure and Post Closure J- Tank Systems S- Special Provisions for Cleanup X- Miscellaneous Units
Section 3004 of the Resource Conservation and Recovery Act (Solid Waste Disposal Act, as amended), 42 USC § 6924	40 CFR § 264. 13(b)	Substantive portions of 40 CFR §264.13(b) are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Owner or operator of a facility that treats, stores or disposes of hazardous wastes must develop and follow a written waste analysis plan.
Resource Conservation and Recovery Act, 42 USC s/s 6901 et seq.-1976	40 CFR Part 264 and 265, Subparts K-264.220-.232 L-264.250-.259 N-264.300-.317	Substantive portions of the referenced Subparts of Parts 264 and 265 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facilities. K- Surface Impounds L-Waste Piles N- Landfills, Subtitle C
Section 3004 of the Resource Conservation and Recovery Act, as amended, 42 USC § 6924	40 CFR § 264.232	Substantive portions of 40 CFR § 264.232 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Owners and operators shall manage all hazardous waste placed in a surface impoundment in accordance with 40 CFR Subparts BB (Air Emission Standards for Equipment Leaks) and CC (Air Emission Standards for Tanks, Surface Impoundments and Containers).

Table A-5
Action-Specific Potential Applicable or Relevant and Appropriate Requirements

Medium/Authority	Citation	Status for FS	Requirement Synopsis
Resource Conservation and Recovery Act, 42 USC s/s 6901 et seq. (1976)	40 CFR Part 268	Substantive portions of 40 CFR Part 268 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Land disposal restrictions C- Prohibitions on Land Disposal
Toxic Substances Control Act (TSCA), Title 1,15 USC § 2605	40 CFR Part 761	Substantive portions of 40 CFR Part 761 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Polychlorinated biphenyls (PCBs) manufacturing, processing, distribution in commerce, and use prohibitions
Hazardous Materials Transportation Act, as amended, 49 USC §§ 5101 – 5127	49 CFR Part 170.	Substantive portions of 49 CFR Part 170 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Transport of hazardous materials program procedures.
Hazardous Materials Transportation Act, as amended, 49 USC §§ 5101 – 5127	49 CFR Part 171	Substantive portions of 49 CFR Part 171 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Department of Transportation Rules for Transportation of Hazardous Materials, including procedures for the packaging, labeling, manifesting and transporting of hazardous materials.
Resource Conservation and Recovery Act, 42 USC s/s 6901 et seq. (1976)	62 Fed. Reg. 25997 and 63 Fed. Reg. 65874	Not an action-specific ARAR for purposes of this on-site response.	Subtitle C, Phase IV Supplemental Proposal on Land Disposal of Mineral Processing Wastes (62 FR 25997), and Hazard Remediation Waste Management requirements (63 FR 65874).

Table A-5
Action-Specific Potential Applicable or Relevant and Appropriate Requirements

Medium/Authority	Citation	Status for FS	Requirement Synopsis
New York State ECL Article 17, Title 5		Substantive portions of 17-0501, 17-0503, 17-0505, 17-0507, 17-0509 and 17-0511 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	It shall be unlawful for any person, directly or indirectly, to throw, drain, run or otherwise discharge into such waters organic or inorganic matter that shall cause or contribute to a condition in contravention of applicable standards identified at 6 NYCRR § 701.1.
New York State ECL Article 11, Title 5	NY ECL § 11-0503	Substantive portions of 11- 0503 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Fish & Wildlife Law against water pollution. No deleterious or poisonous substances shall be thrown or allowed to run into any public or private waters in quantities injurious to fish life, protected wildlife, or waterfowl inhabiting those waters, or injurious to the propagation of fish, protected wildlife, or waterfowl therein.
New York State ECL Article 19, Title 3 - Air Pollution Control Law. Promulgated pursuant to the Federal Clean Air Act, 42 USC § 7401	6 NYCRR Parts 200, 202, 205, 207, 211, 212, 219, and 257.	Substantive portions of 6 NYCRR Parts 200, 202, 205, 207, 211, 212, 219, and 257 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Air Pollution Control Regulations. The emissions of air contaminants that Jeopardize human, plant, or animal life, or is ruinous to property, or causes a level of discomfort is strictly prohibited.
New York State ECL Article 27, Title 7	6 NYCRR Part 360	Substantive portions of 6 NYCRR Part 360 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Solid Waste Management Facilities New York State regulations for design, construction, operation, and closure requirements for solid waste management facilities.

Table A-5
Action-Specific Potential Applicable or Relevant and Appropriate Requirements

Medium/Authority	Citation	Status for FS	Requirement Synopsis
New York State ECL Article 27, Title 11	6 NYCRR Part 361	Substantive portions of 6 NYCRR Part 361 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Siting of Industrial Hazardous Waste Facilities establishes criteria for siting industrial hazardous waste treatment, storage and disposal facilities. Regulates the siting of new industrial hazardous waste facilities located wholly or partially within New York State. Identifies criteria by which the facilities siting board will determine whether to approve a proposed industrial hazardous waste facility.
New York State ECL Article 27, Title 3	6 NYCRR Part 364	Substantive portions of 6 NYCRR Part 364 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Standards for Waste Transportation Regulations governing the collection, transport and delivery of regulated wastes, including hazardous wastes.
New York State ECL Article 27, Title 9	6 NYCRR Parts 370 and 371	Substantive portions of 6 NYCRR Parts 370 and 371 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	New York State regulations for activities associated with hazardous waste Management.
New York State ECL Article 3, Title 3; Article 27, Titles 7 and 9	6 NYCRR Part 372	Substantive portions of 6 NYCRR Part 372 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities. Includes Hazardous Waste Manifest System requirements for generators, transporters, and treatment, storage or disposal facilities, and other requirements applicable to generators and transporters of hazardous waste.

Table A-5
Action-Specific Potential Applicable or Relevant and Appropriate Requirements

Medium/Authority	Citation	Status for FS	Requirement Synopsis
New York State ECL Article 3, Title 3; Article 27, Titles 7 and 9	6 NYCRR Part 373	Substantive portions of 6 NYCRR Part 373 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities. Includes Hazardous Waste Manifest System requirements for generators, transporters, and treatment, storage or disposal facilities, and other requirements applicable to generators and transporters of hazardous waste.
New York State ECL Article 27 Title 13	6 NYCRR Part 375	Substantive portions of 6 NYCRR Part 375 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Inactive Hazardous Waste Disposal Sites. Establishes standards for the development and implementation of inactive hazardous waste disposal site remedial programs.
New York State ECL Article 27, Title 9	6 NYCRR Part 376	Substantive portions of 6 NYCRR Part 376 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	Land Disposal Restrictions. PCB wastes including dredge spoils containing PCBs greater than 50 ppm must be disposed of in accordance with federal regulations at 40 CFR Part 761.
New York State ECL Article 15, Title 5, and Article 17, Title 3	6 NYCRR Part 608	Substantive portions of 6 NYCRR Part 608 are potential relevant and appropriate action-specific ARARs for purposes of on- site response.	Use and Protection of Waters. A permit is required to change, modify, or disturb any protected stream, its bed or banks, or remove from its bed or banks sand or gravel or any other material; or to excavate or place fill in any of the navigable waters of the state. Any applicant for a federal license or permit to conduct any activity which may result in any discharge into navigable waters must obtain a State Water Quality Certification under Section 401 of the Federal Water Pollution Control Act. 33 USC § 1341

Table A-5
Action-Specific Potential Applicable or Relevant and Appropriate Requirements

Medium/Authority	Citation	Status for FS	Requirement Synopsis
New York State ECL, Article 1. Title 1, Article 3 Title 3, Article 15 Title 3, Article 17 Title 1, 3, and 8	6 NYCRR Part 700-706	Substantive portions of 6 NYCRR Parts 701 and 703 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	New York limitations on discharges of sewage, industrial waste or other wastes.
New York State ECL Article 17, Title 8	6 NYCRR Parts 750 – 758	Substantive portions of 6 NYCRR Parts 750 - 758 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.	New York SPDES Requirements Standards for Storm Water Runoff, Surface Water, and Groundwater Discharges, In general, no person shall discharge or cause a discharge to NY State waters of any pollutant without a permit under the New York SPDES program.
Local County or Municipality Pretreatment Requirements	Local regulations	Not an action-specific ARAR for purposes of this on-site response.	Local regulations

Notes:
ARAR = Applicable or Relevant and Appropriate Requirements
CFR = Code of Federal Regulations
ECL = Environmental Conservation Law
NPDES = National Pollutant Discharge Elimination System
NYCRR = New York Codes, Rules, and Regulations
PCB = polychlorinated biphenyl
ppm = parts per million
SPDES = State Pollution Discharge Elimination System
SDWA = Safe Drinking Water Act

Table A-6
Action-Specific Potential Criteria, Advisories, and Guidance to Be Considered

Medium/ Authority	Citation	Status for FS	Requirement Synopsis
EPA	Covers for Uncontrolled Hazardous Waste Sites (EPA/540/2-85-002; September 1985)	TBC	Covers for Uncontrolled Hazardous Waste Sites should include a vegetated top cover, middle drainage layer, and low permeability layer.
EPA	Rules of Thumb for Superfund Remedy Selection (EPA 540-R-97-013, August 1997)	TBC	Describes key principles and expectations, as well as "best practices" based on program experience for the remedy selection process under Superfund. Major policy areas covered are risk assessment and risk management, developing remedial alternatives, and groundwater response actions.
EPA	Land Use in the CERCLA Remedy Selection Process (OSWER Directive No. 9355.7-04, May 1995)	TBC	Presents information for considering land use in making remedy selection decisions at NPL sites.
EPA	Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites (OSWER Directive 9285.6-08, February 2002)	TBC	Presents risk management principles that site managers should consider when making risk management decisions at contaminated sediment sites.
EPA	Contaminated Sediment Strategy (EPA-823-R-98- 001, April 1998)	TBC	Establishes an Agency-wide strategy for contaminated sediments, with the following four goals: 1) prevent the volume of contaminated sediments from increasing; 2) reduce the volume of existing contaminated sediment; 3) ensure that sediment dredging and dredged material disposal are managed in an environmentally sound manner; and 4) develop scientifically sound sediment management tools for use in pollution prevention, source control, remediation, and dredged material management.
EPA	Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (OSWER 9355.0-85 draft November 2002)	TBC	Provides technical and policy guidance for addressing contaminated sediment sites nationwide primarily associated with CERCLA actions.
EPA	Developing Remedial Action Objectives and Cleanup Levels for Contaminated Sediment Sites addressed Under CERCLA, October 2012	TBC	Provides technical and policy guidance under CERCLA for addressing determing remedial action objectives and cleanup requirements at sediment sites.

Table A-6
Action-Specific Potential Criteria, Advisories, and Guidance to Be Considered

Medium/ Authority	Citation	Status for FS	Requirement Synopsis
EPA	Structure and Components of Five-Year Reviews (OSWER Directive 9355.7- 02, May 1991) Supplemental Five-Year Review Guidance (OSWER Directive 9355.7-02A, July 1994) Second Supplemental Five-Year Review Guidance (OSWER 9355.7-03A, December 1995)	TBC	Provides guidance on conducting Five-Year Reviews for sites at which hazardous substances, pollutants, or contaminants remain on-site above levels that allow for unrestricted use and unlimited exposure. The purpose of the Five-Year Review is to evaluate whether the selected response action continues to be protective of public health and the environment and is functioning as designed.
EPA	40 CFR Part 50	TBC	Clean Air Act, National Ambient Air Quality Standards
USACE	USACE, Notice on Issuance of Nationwide Permits, 67 Fed. Reg. 2020 (Jan. 15, 2002).	TBC	
DEC	Letter from William R. Adriance, Chief Permit Administrator, to Richard Tomer and Paul G. Leuchner, Chiefs of the New York and Buffalo Districts of USACE, re. Section 401 Water Quality Certification, January 15, 2002 Nationwide Permits (Mar. 15, 2002).	TBC	
DEC	New York Guidelines for Soil Erosion and Sediment Control	TBC	
DEC	Air Guide 1 - Guidelines for the Control of Toxic Ambient Air Contaminants, 2000	TBC	Provides guidance for the control of toxic ambient air contaminants in New York State. Current annual guideline concentrations for PCBs are 0.01 µg/m3 for inhalation of evaporative congeners (Aroclor 1242 and below) and 0.002 µg/m3 for inhalation of persistent highly chlorinated congeners (Aroclor 1248 and above) in the form of dust or aerosols.
DEC	Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water	TBC	Provides guidance for ambient water quality standards and guidance values for pollutants
DEC	TOGS 1.2.1 Industrial SPDES Permit Drafting Strategy for Surface Waters	TBC	Provides guidance for writing permits for discharges of wastewater from industrial facilities and for writing requirements equivalent to SPDES permits for discharges from remediation sites.

Table A-6
Action-Specific Potential Criteria, Advisories, and Guidance to Be Considered

Medium/ Authority	Citation	Status for FS	Requirement Synopsis
DEC	TOGS 1.3.1 Waste Assimilative Capacity Analysis & Allocation for Setting	TBC	Provides guidance to water quality control engineers in determining whether discharges to water bodies have a reasonable potential to violate water quality standards and guidance values.
DEC	TOGS 1.3.2 Toxicity Testing in the SPDES Permit Program	TBC	Describes the criteria for deciding when toxicity testing will be required in a permit and the procedures which should be followed when including toxicity testing requirements in a permit.
DEC	TOGS 2.1.1, Guidance on Groundwater Contamination Strategy	TBC	
DEC, Division of Environ-mental Remedi-ation	Technical and Administrative Guidance Memorandum (TAGM) 4031 Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites	TBC	Provides guidance on fugitive dust suppression and particulate monitoring for inactive hazardous waste sites.
DEC	Interim Guidance on Freshwater Navigational Dredging, October 1994	TBC	Provides guidance for navigational dredging activities in freshwater areas.
DEC Division of Fish, Wildlife and Marine Resources	Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites, October 1994	TBC	Provides rationale and methods for sampling and evaluating impacts of a site on fish and wildlife during the remedial investigation and other stages of the remedial process
DEC TAGM 3028	"Contained-In Criteria for Environmental Media (November 30, 1992).	TBC	Provides "contained-in" concentrations/ action levels for environmental media and the basis for these criteria.

Notes:

CERLCA = Comprehensive Environmental Response, Compensation and Liability Act

CFR = Code of Federal Regulations

DEC = Department of Environmental Conservation

EPA = U.S. Environmental Protection Agency

NPL = National Priority List

OSWER = Office of Solid Waste and Emergency Response

PCB = polychlorinated biphenyl

SPDES = State Pollution Discharge Elimination System

TBC = To Be Considered

TAGM = Technical and Administrative Guidance Memorandum

TOGS = Technical and Operational Guidance Series

USACE = U.S. Army Corps of Engineers

APPENDIX B

Development of Soil and Sediment PRGs

APPENDIX B

DEVELOPMENT OF SOIL AND SEDIMENT PRELIMINARY REMEDIATION GOALS

LOWER LEY CREEK SUBSITE OF THE ONONDAGA LAKE SUPERFUND SITE, SYRACUSE, NY

1.0 PRG CALCULATION SUMMARY

This appendix presents the information and rationale used in the identification of PRGs for the FS. PRGs were calculated following the assumptions and information (e.g., exposure assumptions, ingestion rates, etc.) presented in the HHRA and BERA. The Human Health and Ecological PRGs are presented in Table 1 and Table 2, respectively. The Human Health and Ecological PRG calculations are detailed in Tables 1.A through 1.J and Tables 2.A through 2.F, respectively.

1.1 HUMAN HEALTH PRGS

PRGs were calculated for exposure to all identified site COCs in site soil, sediment, and fish tissue. Site COCs were identified as contaminants contributing a cancer risk exceeding 1E-05 to a cumulative cancer risk greater than 1E-04, or a contaminant that contributed substantially to a non-cancer target organ hazard index (HI) greater than 1. Identification was based on the reasonable maximum exposure (RME) scenarios. To be consistent with the baseline HHRA, the inhalation exposure route was not considered in the PRG calculations. Because inhalation generally contributes negligibly to overall risk, this approach is appropriate.

1.1.1 Soil

The following COCs were identified for the site soil: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-c,d)pyrene, chromium, PCB-1248, and PCB-1260. The majority of the COCs were identified because of excessive contributions to cumulative cancer risks. PCB-1260 was identified solely because of contributions to non-cancer hazards.

For each of these COCs, PRGs were calculated for the following receptors: Adult Recreational Visitor, Older Child Recreational Visitor (6 to 16 years old), Younger Child Recreational Visitor (less than 6 years old), and Construction Worker. Calculated soil PRGs for these receptors are presented in Table 1, along with the New York Remedial Program Soil Cleanup Objectives. These values were compared to the calculated PRGs to identify the most conservative proposed cleanup level for each COC (most conservative PRG is shaded).

1.1.2 Sediment

The following COCs were identified in site sediment for at least one site receptor: 3-methylcholanthrene, benzo(a)pyrene, dibenzo(a,h)anthracene, PCB-1260, and vanadium. For each of these COCs (where applicable), PRGs were calculated for the following receptors: Adult Recreational Visitor, Older Child Recreational Visitor (6 to 16 years old), and Younger Child Recreational Visitor (less than 6 years old). PRGs were not calculated for the Construction Worker because no COCs were identified for this receptor. Calculated sediment PRGs for these receptors are presented in Table 1. New York sediment screening values (for sediment direct contact) are not available. Accordingly, the most conservative calculated PRG is identified as the proposed PRG for each COC (most conservative PRG is shaded).

1.1.3 Fish Tissue

The following COCs were identified for exposure to fish tissue: PCB-1254, PCB-1260, total PCBs, total dioxins/furans (as TEQ), dieldrin, arsenic, chromium, and mercury. For these COCs, PRGs were calculated for the Adult Recreational Visitor, Older Child Recreational Visitor (6 to 16 years old), and Younger Child Recreational Visitor (less than 6 years old). PRGs were not calculated for the Construction Worker because this exposure pathway was identified as incomplete.

After the calculation of fish tissue PRGs (mg/kg fish tissue), an associated sediment PRG concentration (mg/kg sediment) was calculated using site-specific biota-sediment accumulation factors (BSAFs). This sediment PRG concentration is protective of the fish ingestion pathway. Site-specific BSAFs were calculated by dividing the fish tissue exposure point concentration (EPC) for each contaminant by the sediment EPC. These EPCs (95% UCLs) were obtained from the Lower Ley Creek BERA. The calculation of fish tissue PRGs is detailed in Tables 1.H through 1.J.

Calculated fish tissue PRGs (in both mg/kg of fish tissue and mg/kg of sediment) are presented in Table 1. Also presented in Table 1 are the New York Sediment Screening Criteria for Human Health Bioaccumulation (mg/kg of sediment). These values were compared to the calculated PRGs to identify the most conservative proposed cleanup level for each COC (most conservative PRG is shaded).

1.2 ECOLOGICAL PRGS

Ecological PRGs were calculated or identified for the ecological receptors and sediment COCs identified in the BERA. These PRGs are summarized in Table 2. In addition, soil at Lower Ley Creek was evaluated with respect to ecological receptors to determine the extent of potential risk associated with exposure of ecological receptors to site surface soil. These evaluations are discussed below.

1.2.1 Sediment

Ecological receptors identified within the BERA as having potential risk from exposure to site sediment include upper level trophic receptors (piscivorous mammals and birds) and benthic invertebrates. For upper trophic level receptors, PRGs were calculated (using a food web) to be protective of the mink (piscivorous mammal) and belted kingfisher (piscivorous bird). These two receptors were the most conservative of the four evaluated in the BERA. The food web calculations (presented in Table 2.A) incorporated direct contact with sediment (ingestion of sediment), bioaccumulation of sediment in fish tissue (ingestion of fish tissue), and direct contact with surface water (ingestion of surface water). All exposure parameters for the food web calculations (e.g., sediment ingestion rates, diet composition, body weight, etc.) were obtained from the BERA. To provide risk management information, two PRGs were calculated for each COC: one based on the LOAEL and one based on the NOAEL. The BSAFs were calculated from the sediment and fish tissue concentrations presented in the BERA.

Several inorganics and total PAHs were identified within the BERA (benchmark screening) as posing a potential threat to benthic invertebrates via exposure to site sediment. These COCs include arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc, and total PAHs. Within the BERA, "no effect" concentrations were identified via toxicity testing for each of the identified COCs. These concentrations are presented in detail in Table 2.B and are identified as the proposed PRGs for the benthic invertebrate receptor.

The food web and benthic invertebrate PRGs are summarized in Table 2. Also presented in Table 2 are the New York Sediment Screening Criteria for Metals, for Benthic Aquatic Life (Chronic Toxicity), and for Wildlife Bioaccumulation. These values were compared to the calculated PRGs to identify the most conservative proposed cleanup level for each COC (most conservative PRG is shaded).

1.2.2 Soil

Because soil was not evaluated in the BERA, this PRG evaluation also evaluated potential risk to ecological receptors from exposure to site soil. For this evaluation, maximum surface soil concentrations of all detected analytes (obtained from the Human Health Risk Assessment, Table 2s) were compared to benchmark values protective of ecological receptors. This evaluation is presented in Table 2.C. Benchmark values were obtained from U.S. EPA Eco-SSLs, New York Soil Cleanup Objectives for Protection of Ecological Resources, and U.S. EPA Region 5 Ecological Soil Screening Levels. Precedence was given to the Eco-SSLs in the screening process.

As shown in Table 2.C, the maximum detected soil concentration of the following analytes exceeded the associated benchmark screening level:

Metals

- Antimony
- Barium
- Cadmium
- Chromium
- Copper
- Lead
- Manganese
- Mercury

Organics

- Butylbenzylphthalate
- Di-n-butylphthalate
- Endrin
- DDT and Metabolites
- PCB-1248
- PCB-1260
- High molecular weight PAHs
- Low molecular weight PAHs

Metals	**Organics**
• Nickel	
• Selenium	
• Silver	
• Vanadium	
• Zinc	

The vanadium and manganese results may reflect natural soil conditions. In addition, maximum barium, selenium, and dibutyl phthalate concentrations only slightly exceeded their screening values. It is unlikely these analytes would pose a significant ecological threat.

Table 1
Human Health Risk-based Cleanup Values
Summary Table

Ley Creek - Soil											
CAS Number	Constituent	Lower Ley Creek Soil EPC utilized in HHRA (mg/kg)	New York Remedial Program Soil Cleanup Objectives (mg/kg)	Proposed Lower Ley Creek PRG - Adult Recreational Visitor (mg/kg)		Proposed Lower Ley Creek PRG - Older Child Recreational Visitor (mg/kg)		Proposed Lower Ley Creek PRG - Younger Child Recreational Visitor (mg/kg)		Proposed Lower Ley Creek PRG - Construction Worker (mg/kg)	
				Cancer	Non-Cancer	Cancer	Non-Cancer	Cancer	Non-Cancer	Cancer	Non-Cancer
COCs											
	Benzo(a)anthracene	9.2	1	--	--	1.7	--	0.66	--	--	--
	Benzo(a)pyrene	5.8	1	1.8	--	0.17	--	0.066	--	--	--
	Benzo(b)fluoranthene	6.1	1	--	--	1.7	--	0.66	--	--	--
	Dibenzo(a,h)anthracene	0.96	0.33	--	--	0.17	--	0.066	--	--	--
	Indeno(1,2,3-c,d)pyrene	3.3	0.5	--	--	1.7	--	0.66	--	--	--
	Chromium	275	1	83	5,360	42	4,441	6.5	574	--	--
	Aroclor 1260		0.1	--	--	2.0	0.57	1.7	0.3	--	--
	Aroclor 1248	11	0.1	6.1	11	2.0	0.57	1.7	0.3	17	2.0

Ley Creek - Sediment (Direct Contact)									
CAS Number	Constituent	Lower Ley Creek Sediment EPC utilized in HHRA (mg/kg)	New York Remedial Program Soil Cleanup Objectives (mg/kg)	Proposed Lower Ley Creek PRG - Adult Recreational Visitor (mg/kg)		Proposed Lower Ley Creek PRG - Older Child Recreational Visitor (mg/kg)		Proposed Lower Ley Creek PRG - Younger Child Recreational Visitor (mg/kg)	
				Cancer	Non-Cancer	Cancer	Non-Cancer	Cancer	Non-Cancer
COCs									
56-49-5	3-Methylcholanthrene	5.7	--	--	--	0.96	--	0.15	--
50-32-8	Benzo(a)pyrene	8.9	--	1.8	--	0.17	--	0.066	--
53-70-3	Dibenzo(a,h)anthracene	0.73	--	--	--	--	--	0.066	--
11096-82-5	Aroclor 1260	18	--	--	--	2.0	1.1	1.7	0.59

Ley Creek - Sediment (Bioaccumulation into Fish Tissue)									
CAS Number	Constituent	Lower Ley Creek Fish Tissue EPC utilized in HHRA (mg/kg in fish tissue)	New York Sediment Criteria - Human Health Bioaacumulation[a] (mg/kg in sediment)	Proposed Lower Ley Creek PRG - Adult Recreational Visitor (mg/kg in sediment)		Proposed Lower Ley Creek PRG - Older Child Recreational Visitor (mg/kg in sediment)		Proposed Lower Ley Creek PRG - Younger Child Recreational Visitor (mg/kg in sediment)	
				Cancer	Non-Cancer	Cancer	Non-Cancer	Cancer	Non-Cancer
COCs									
11097-69-1	Aroclor-1254	1.2	0.0008	--	0.0027	--	0.0034	--	0.0018
11096-82-5	Aroclor-1260	0.58	0.0008	--	0.30	--	0.37	--	0.19
--	Total PCBs	1.3	0.0008	0.49	--	1.8	--	1.6	--
1746-01-6	Total D/F, as TEQ	0.0000035	--	0.000051	0.00023	0.00019	0.00028	0.00016	0.00015
60-57-1	Dieldrin	0.017	0.1	0.011	0.36	0.039	0.45	0.034	0.23
7440-38-2	Arsenic	1.4	6[b]	1.8	34	6.5	42	5.7	22
7440-47-3	Chromium	44	26[b]	62	3,999	77	4,960	38	2,581
7439-97-6	Mercury	0.48	0.15[b]	--	2.4	--	3.0	--	1.6

Notes:

a = Organic sediment screening values obtained from Table 1: Sediment Criteria for Non-polar Organic Compounds in "Technical Guidance for Screening Contaminated Sediments, New York State Department of Environmental Conservation, January 1999."

b = Metals sediment screening values obtained from Table 2: Sediment Criteria for Metals in "Technical Guidance for Screening Contaminated Sediments, New York State Department of Environmental Conservation, January 1999."

EPC = Exposure Point Concentration.

PRG = Preliminary Remdiation Goal.

(shaded) = Lowest proposed PRG

-- = not available or not applicable

Table 1.A
Human Health Risk-Based Cleanup Values
Lower Ley Creek Soil
Adult Recreational Visitor (>16 years)

Adult Recreational Visitor (> 16 years)				
Constituent	**Soil EPC Utilized in HHRA**	**Proposed Cleanup Value (mg/kg)**	**Target Organ**	**Receptor Scenario Hazard Index**
Non-Cancer Risk				
Benzo(a)pyrene	5.82	--	--	--
Chromium	275	*5,360*	Gastrointestinal	1
Aroclor 1248	11.41	*11*	Whole body	1
Cancer Risk				
Benzo(a)pyrene	5.82	*1.77*	--	1.E-05
Chromium	275	*83.4*	--	1.E-05
Aroclor 1248	11.41	*6.14*	--	1.E-05

Exposure Parameters Utilized in HHRA			
Parameter	**Definition**	**Units**	**Value**
CF	Unit Conversion Factor for Soil	kg/mg	0.000001
IR	Ingestion Rate of Soil	mg/day	100
FI	Fraction Ingested from Soil	unitless	1
EF	Exposure Frequency	days/year	143
ED	Exposure Duration	years	30
SA	Skin Surface Area for Dermal Absorption	cm^2/day	5,700
AF	Soil to Skin Adherence Factor	mg/cm^2	0.3
BW	Body Weight	kg	70
AT-NC	Averaging Time - Non-Cancer	days	10,950
AT-C	Averaging Time - Cancer	days	25,550
Ingestion Intake Multiplier - Non-Cancer		day^{-1}	5.59687E-07
Dermal Intake Multiplier - Non-Cancer		day^{-1}	9.57065E-06
Ingestion Intake Multiplier - Cancer		day^{-1}	2.40E-07
Dermal Intake Multiplier - Cancer		day^{-1}	4.10E-06

Chemical-Specific Parameters Utilized in HHRA - Non-Cancer							
Chemical of Potential Concern	**Oral RfD**		**Oral Absorption Efficiency for Dermal (unitless)**	**Absorbed RfD for Dermal**		**Dermal Absorption Factor**	
	Value	**Units**		**Value**	**Units**	**Value**	**Units**
COCs							
Benzo(a)pyrene	--	mg/kg-day	1	--	mg/kg-day	1.3E-01	Unitless
Chromium	3.0E-03	mg/kg-day	0.025	7.5E-05	mg/kg-day	--	
Aroclor 1248	2.0E-05	mg/kg-day	1	2.0E-05	mg/kg-day	1.4E-01	Unitless

Chemical-Specific Parameters Utilized in HHRA - Cancer							
Chemical of Potential Concern	**Oral CSF**		**Oral Absorption Efficiency for Dermal (unitless)**	**Absorbed CSF for Dermal**		**Dermal Absorption Factor**	
	Value	**Units**		**Value**	**Units**	**Value**	**Units**
COCs							
Benzo(a)pyrene	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1	7.3E+00	(mg/kg-day)-1	1.3E-01	Unitless
Chromium	5.0E-01	(mg/kg-day)-1	0.025	2.0E+01	(mg/kg-day)-1	--	
Aroclor 1248	2.0E+00	(mg/kg-day)-1	1	2.0E+00	(mg/kg-day)-1	1.4E-01	Unitless

Table 1.B
Human Health Risk-Based Cleanup Values - Lower Ley Creek Soil
Older Child Recreational Visitor (6 to 16 years)

Older Child Recreational Visitor (6 to 16 years)				
Constituent	**Soil EPC Utilized in HHRA**	***Proposed Cleanup Value (mg/kg)***	**Target Organ**	**Receptor Scenario Hazard Index**
Non-Cancer Risk				
Benzo(a)anthracene	9.2	--	--	--
Benzo(a)pyrene	5.82	--	--	--
Benzo(b)fluoranthene	6.13	--	--	--
Dibenzo(a,h)anthracene	0.96	--	--	--
Indeno(1,2,3-c,d)pyrene	3.31	--	--	--
Chromium	275	*4,441*	Gastrointestinal	1
Aroclor 1260		*0.57*	Whole Body	0.5
Aroclor 1248	11.41	*0.57*	Whole Body	0.5
Cancer Risk				
Benzo(a)anthracene	9.2	*1.66*	--	1.E-05
Benzo(a)pyrene	5.82	*0.17*	--	1.E-05
Benzo(b)fluoranthene	6.13	*1.66*	--	1.E-05
Dibenzo(a,h)anthracene	0.96	*0.17*	--	1.E-05
Indeno(1,2,3-c,d)pyrene	3.31	*1.66*	--	1.E-05
Chromium	275	*42.39*	--	1.E-05
Aroclor 1260		*2.00*	--	1.E-05
Aroclor 1248	11.41	*2.00*	--	1.E-05

Exposure Parameters Utilized in HHRA			
Parameter	**Definition**	**Units**	**Value**
CF	Unit Conversion Factor for Soil	kg/mg	0.000001
IR	Ingestion Rate of Soil	mg/day	100
FI	Fraction Ingested from Soil	unitless	1
EF	Exposure Frequency	days/year	143
ED	Exposure Duration	years	10
SA	Skin Surface Area for Dermal Absorption	cm^2/day	5,400
AF	Soil to Skin Adherence Factor	mg/cm^2	3.3
BW	Body Weight	kg	58
AT-NC	Averaging Time - Non-Cancer	days	3,650
AT-C	Averaging Time - Cancer	days	25,550
IRS-S-Adj	Age-Adjusted Ingestion Rate of Soil	mg-yr/day-kg	28.1
SSAF-Adj	Age-Adjusted Soil to Skin Adherence Factor	mg-yr/day-kg	3,574.9
Ingestion Intake Multiplier - Non-Cancer		day^{-1}	6.75484E-07
Dermal Intake Multiplier - Non-Cancer		day^{-1}	0.000120371
Ingestion Intake Multiplier - Cancer		day^{-1}	9.65E-08
Dermal Intake Multiplier - Cancer		day^{-1}	1.72E-05

Chemical-Specific Parameters Utilized in HHRA - Non-Cancer							
Chemical of Potential Concern	**Oral RfD**		**Oral Absorption Efficiency for Dermal (unitless)**	**Absorbed RfD for Dermal**		**Dermal Absorption Factor**	
	Value	**Units**		**Value**	**Units**	**Value**	**Units**
COCs							
Benzo(a)anthracene	--	mg/kg-day	1	--	mg/kg-day	0.13	Unitless
Benzo(a)pyrene	--	mg/kg-day	1	--	mg/kg-day	0.13	Unitless
Benzo(b)fluoranthene	--	mg/kg-day	1	--	mg/kg-day	0.13	Unitless
Dibenzo(a,h)anthracene	--	mg/kg-day	1	--	mg/kg-day	0.13	Unitless
Indeno(1,2,3-c,d)pyrene	--	mg/kg-day	1	--	mg/kg-day	0.13	Unitless
Chromium	3.0E-03	mg/kg-day	0.025	7.5E-05	mg/kg-day	--	Unitless
Aroclor 1260	2.0E-05	mg/kg-day	1	2.0E-05	mg/kg-day	0.14	Unitless
Aroclor 1248	2.0E-05	mg/kg-day	1	2.0E-05	mg/kg-day	0.14	Unitless

Chemical-Specific Parameters Utilized in HHRA - Cancer							
Chemical of Potential Concern	**Oral CSF**		**Oral Absorption Efficiency for Dermal (unitless)**	**Absorbed CSF for Dermal**		**Dermal Absorption Factor**	
	Value	**Units**		**Value**	**Units**	**Value**	**Units**
COCs							
Benzo(a)anthracene	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1	7.30E-01	$(mg/kg\text{-}day)^{-1}$	0.13	Unitless
Benzo(a)pyrene	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1	7.30E+00	$(mg/kg\text{-}day)^{-1}$	0.13	Unitless
Benzo(b)fluoranthene	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1	7.30E-01	$(mg/kg\text{-}day)^{-1}$	0.13	Unitless
Dibenzo(a,h)anthracene	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1	7.30E+00	$(mg/kg\text{-}day)^{-1}$	0.13	Unitless
Indeno(1,2,3-c,d)pyrene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	0.13	Unitless
Chromium	5.0E-01	$(mg/kg\text{-}day)^{-1}$	0.025	2.0E+01	$(mg/kg\text{-}day)^{-1}$	--	Unitless
Aroclor 1260	2.0E+00	$(mg/kg\text{-}day)^{-1}$	1	2.0E+00	$(mg/kg\text{-}day)^{-1}$	0.14	Unitless
Aroclor 1248	2.0E+00	$(mg/kg\text{-}day)^{-1}$	1	2.0E+00	$(mg/kg\text{-}day)^{-1}$	0.14	Unitless

Table 1.C
Human Health Risk-Based Cleanup Values - Lower Ley Creek Soil
Younger Child Recreational Visitor (< 6 years)

Younger Child Recreational Visitor (< 6 years)				
Constituent	**Soil EPC Utilized in HHRA**	***Proposed Cleanup Value (mg/kg)***	**Target Organ**	**Receptor Scenario Hazard Index**
Non-Cancer Risk				
Benzo(a)anthracene	9.2	--	--	--
Benzo(a)pyrene	5.82	--	--	--
Benzo(b)fluoranthene	6.13	--	--	--
Dibenzo(a,h)anthracene	0.96	--	--	--
Indeno(1,2,3-c,d)pyrene	3.31	--	--	--
Chromium	275	*574*	Gastrointestinal	1
Aroclor 1260		*0.30*	Whole Body	0.5
Aroclor 1248	11.41	*0.30*	Whole Body	0.5
Cancer Risk				
Benzo(a)anthracene	9.2	*0.66*	--	1.E-05
Benzo(a)pyrene	5.82	*0.066*	--	1.E-05
Benzo(b)fluoranthene	6.13	*0.66*	--	1.E-05
Dibenzo(a,h)anthracene	0.96	*0.066*	--	1.E-05
Indeno(1,2,3-c,d)pyrene	3.31	*0.66*	--	1.E-05
Chromium	275	*6.54*	--	1.E-05
Aroclor 1260		*1.72*	--	1.E-05
Aroclor 1248	11.41	*1.72*	--	1.E-05

Exposure Parameters Utilized in HHRA			
Parameter	**Definition**	**Units**	**Value**
CF	Unit Conversion Factor for Soil	kg/mg	0.000001
IR	Ingestion Rate of Soil	mg/day	200
FI	Fraction Ingested from Soil	unitless	1
EF	Exposure Frequency	days/year	143
ED	Exposure Duration	years	6
SA	Skin Surface Area for Dermal Absorption	cm^2/day	2,800
AF	Soil to Skin Adherence Factor	mg/cm^2	2.8
BW	Body Weight	kg	15
AT-NC	Averaging Time - Non-Cancer	days	2,190
AT-C	Averaging Time - Cancer	days	25,550
IRS-S-Adj (0-2 years)	Age-Adjusted Ingestion Rate of Soil	mg-yr/day-kg	39.7
IRS-S-Adj (2-6 years)	Age-Adjusted Ingestion Rate of Soil	mg-yr/day-kg	49.8
SSAF-Adj (0-2 years)	Age-Adjusted Soil to Skin Adherence Factor	mg-yr/day-kg	1,702.7
SSAF-Adj (2-6 years)	Age-Adjusted Soil to Skin Adherence Factor	mg-yr/day-kg	2,375.3
Ingestion Intake Multiplier - Non-Cancer		day^{-1}	5.22374E-06
Dermal Intake Multiplier - Non-Cancer		day^{-1}	0.000204771
Ingestion Intake Multiplier - Cancer		day^{-1}	4.48E-07
Dermal Intake Multiplier - Cancer		day^{-1}	1.76E-05

Chemical-Specific Parameters Utilized in HHRA - Non-Cancer							
Chemical of Potential Concern	**Oral RfD**		**Oral Absorption Efficiency for Dermal (unitless)**	**Absorbed RfD for Dermal**		**Dermal Absorption Factor**	
	Value	**Units**		**Value**	**Units**	**Value**	**Units**
COCs							
Benzo(a)anthracene	--	mg/kg-day	1	--	mg/kg-day	0.13	Unitless
Benzo(a)pyrene	--	mg/kg-day	1	--	mg/kg-day	0.13	Unitless
Benzo(b)fluoranthene	--	mg/kg-day	1	--	mg/kg-day	0.13	Unitless
Dibenzo(a,h)anthracene	--	mg/kg-day	1	--	mg/kg-day	0.13	Unitless
Indeno(1,2,3-c,d)pyrene	--	mg/kg-day	1	--	mg/kg-day	0.13	Unitless
Chromium	3.0E-03	mg/kg-day	0.025	1.0E-01	mg/kg-day	--	Unitless
Aroclor 1260	2.0E-05	mg/kg-day	1	2.0E-05	mg/kg-day	0.14	Unitless
Aroclor 1248	2.0E-05	mg/kg-day	1	2.0E-05	mg/kg-day	0.14	Unitless
Chemical-Specific Parameters Utilized in HHRA - Cancer							
Chemical of Potential Concern	**Oral CSF**		**Oral Absorption Efficiency for Dermal (unitless)**	**Absorbed CSF for Dermal**		**Dermal Absorption Factor**	
	Value	**Units**		**Value**	**Units**	**Value**	**Units**
COCs							
Benzo(a)anthracene	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1	7.30E-01	$(mg/kg\text{-}day)^{-1}$	0.13	Unitless
Benzo(a)pyrene	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1	7.30E+00	$(mg/kg\text{-}day)^{-1}$	0.13	Unitless
Benzo(b)fluoranthene	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1	7.30E-01	$(mg/kg\text{-}day)^{-1}$	0.13	Unitless
Dibenzo(a,h)anthracene	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1	7.30E+00	$(mg/kg\text{-}day)^{-1}$	0.13	Unitless
Indeno(1,2,3-c,d)pyrene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	0.13	Unitless
Chromium	5.0E-01	$(mg/kg\text{-}day)^{-1}$	0.025	2.0E+01	$(mg/kg\text{-}day)^{-1}$	--	Unitless
Aroclor 1260	2.0E+00	$(mg/kg\text{-}day)^{-1}$	1	2.0E+00	$(mg/kg\text{-}day)^{-1}$	0.14	Unitless
Aroclor 1248	2.0E+00	$(mg/kg\text{-}day)^{-1}$	1	2.0E+00	$(mg/kg\text{-}day)^{-1}$	0.14	Unitless

Table 1.D
Human Health Risk-Based Cleanup Values - Lower Ley Creek Soil
Adult Construction Worker

Adult Recreational Visitor (> 16 years)				
Constituent	**Soil EPC Utilized in HHRA**	***Proposed Cleanup Value (mg/kg)***	**Target Organ**	**Receptor Scenario Hazard Index**
Non-Cancer Risk				
Aroclor 1248	11.41	*1.95*	None	1
Cancer Risk				
Aroclor 1248	11.41	*17*	--	1.E-05

Exposure Parameters Utilized in HHRA			
Parameter	**Definition**	**Units**	**Value**
CF	Unit Conversion Factor for Soil	kg/mg	0.000001
IR	Ingestion Rate of Soil	mg/day	330
FI	Fraction Ingested from Soil	unitless	1
EF	Exposure Frequency	days/year	250
ED	Exposure Duration	years	2
SA	Skin Surface Area for Dermal Absorption	cm^2/day	5,700
AF	Soil to Skin Adherence Factor	mg/cm^2	0.9
BW	Body Weight	kg	70
AT-NC	Averaging Time - Non-Cancer	days	730
AT-C	Averaging Time - Cancer	days	25,550
Ingestion Intake Multiplier - Non-Cancer		day^{-1}	3.22896E-06
Dermal Intake Multiplier - Non-Cancer		day^{-1}	5.01957E-05
Ingestion Intake Multiplier - Cancer		day^{-1}	9.23E-08
Dermal Intake Multiplier - Cancer		day^{-1}	1.43E-06

Chemical-Specific Parameters Utilized in HHRA - Non-Cancer							
Chemical of Potential Concern	**Oral RfD**		**Oral Absorption Efficiency for Dermal (unitless)**	**Absorbed RfD for Dermal**		**Dermal Absorption Factor**	
	Value	**Units**		**Value**	**Units**	**Value**	**Units**
COCs							
Aroclor 1248	2.0E-05	mg/kg-day	1.0E+00	2.0E-05	mg/kg-day	1.4E-01	Unitless
Chemical-Specific Parameters Utilized in HHRA - Cancer							
Chemical of Potential Concern	**Oral CSF**		**Oral Absorption Efficiency for Dermal (unitless)**	**Absorbed CSF for Dermal**		**Dermal Absorption Factor**	
	Value	**Units**		**Value**	**Units**	**Value**	**Units**
COCs							
Aroclor 1248	2.0E+00	(mg/kg-day)-1	1.0E+00	2.0E+00	(mg/kg-day)-1	1.4E-01	Unitless

Table 1.E
Human Health Risk-Based Cleanup Values - Lower Ley Creek Sediment
Adult Recreational Visitor (> 16 years)

Adult Recreational Visitor (> 16 years)				
Constituent	**Sediment EPC Utilized in HHRA**	***Proposed Cleanup Value (mg/kg)***	**Target Organ**	**Receptor Scenario Hazard Index**
Non-Cancer Risk				
Benzo(a)pyrene	8.888	--	--	--
Cancer Risk				
Benzo(a)pyrene	8.888	*1.8*	--	0.00001

Exposure Parameters Utilized in HHRA			
Parameter	**Definition**	**Units**	**Value**
CF	Unit Conversion Factor for Sediment	kg/mg	0.000001
IR	Ingestion Rate of Sediment	mg/day	100
FI	Fraction Ingested from Sediment	unitless	1
EF	Exposure Frequency	days/year	143
ED	Exposure Duration	years	30
SA	Skin Surface Area for Dermal Absorption	cm^2/day	5,700
AF	Sediment to Skin Adherence Factor	mg/cm^2	0.3
BW	Body Weight	kg	70
AT-NC	Averaging Time - Non-Cancer	days	10,950
AT-C	Averaging Time - Cancer	days	25,550
Ingestion Intake Multiplier - Non-Cancer		day^{-1}	5.59687E-07
Dermal Intake Multiplier - Non-Cancer		day^{-1}	9.57065E-06
Ingestion Intake Multiplier - Cancer		day^{-1}	2.40E-07
Dermal Intake Multiplier - Cancer		day^{-1}	4.10E-06

Chemical-Specific Parameters Utilized in HHRA - Non-Cancer							
Chemical of Potential Concern	**Oral RfD**		**Oral Absorption Efficiency for Dermal (unitless)**	**Absorbed RfD for Dermal**		**Dermal Absorption Factor**	
	Value	**Units**		**Value**	**Units**	**Value**	**Units**
COCs							
Benzo(a)pyrene	--	mg/kg-day	1	--	mg/kg-day	1.3E-01	Unitless
Chemical-Specific Parameters Utilized in HHRA - Cancer							
Chemical of Potential Concern	**Oral CSF**		**Oral Absorption Efficiency for Dermal (unitless)**	**Absorbed CSF for Dermal**		**Dermal Absorption Factor**	
	Value	**Units**		**Value**	**Units**	**Value**	**Units**
COCs							
Benzo(a)pyrene	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1	7.3E+00	(mg/kg-day)-1	1.3E-01	Unitless

Table 1.F
Human Health Risk-Based Cleanup Values - Lower Ley Creek Sediment
Older Child Recreational Visitor (6 to 16 years)

Older Child Recreational Visitor (6 to 16 years)				
Constituent	**Sediment EPC Utilized in HHRA**	***Proposed Cleanup Value (mg/kg)***	**Target Organ**	**Receptor Scenario Hazard Index**
Non-Cancer Risk				
3-Methylcholanthrene	5.7	--	--	--
Benzo(a)pyrene	8.888	--	--	--
Aroclor 1260	18	*1.1*	None	1
Cancer Risk				
3-Methylcholanthrene	5.7	*0.96*	--	1.E-05
Benzo(a)pyrene	8.888	*0.17*	--	1.E-05
Aroclor 1260	18	*2.0*	--	1.E-05

Exposure Parameters Utilized in HHRA			
Parameter	**Definition**	**Units**	**Value**
CF	Unit Conversion Factor for Sediment	kg/mg	0.000001
IR	Ingestion Rate of Sediment	mg/day	100
FI	Fraction Ingested from Sediment	unitless	1
EF	Exposure Frequency	days/year	143
ED	Exposure Duration	years	10
SA	Skin Surface Area for Dermal Absorption	cm^2/day	5,400
AF	Sediment to Skin Adherence Factor	mg/cm^2	3.3
BW	Body Weight	kg	58
AT-NC	Averaging Time - Non-Cancer	days	3,650
AT-C	Averaging Time - Cancer	days	25,550
IRS-S-Adj	Age-Adjusted Ingestion Rate of Sediment	mg-yr/day-kg	28.1
SSAF-Adj	Age-Adjusted Sediment to Skin Adherence Factor	mg-yr/day-kg	3,574.9
Ingestion Intake Multiplier - Non-Cancer		day^{-1}	6.75484E-07
Dermal Intake Multiplier - Non-Cancer		day^{-1}	0.000120371
Ingestion Intake Multiplier - Cancer		day^{-1}	9.65E-08
Dermal Intake Multiplier - Cancer		day^{-1}	1.72E-05

Chemical-Specific Parameters Utilized in HHRA - Non-Cancer							
Chemical of Potential Concern	**Oral RfD**		**Oral Absorption Efficiency for Dermal (unitless)**	**Absorbed RfD for Dermal**		**Dermal Absorption Factor**	
	Value	**Units**		**Value**	**Units**	**Value**	**Units**
COCs							
3-Methylcholoanthrene	--	mg/kg-day	1	--	mg/kg-day	--	Unitless
Benzo(a)pyrene	--	mg/kg-day	1	--	mg/kg-day	0.13	Unitless
Aroclor 1260	2.0E-05	mg/kg-day	1	2.0E-05	mg/kg-day	0.14	Unitless
Chemical-Specific Parameters Utilized in HHRA - Cancer							
Chemical of Potential Concern	**Oral CSF**		**Oral Absorption Efficiency for Dermal (unitless)**	**Absorbed CSF for Dermal**		**Dermal Absorption Factor**	
	Value	**Units**		**Value**	**Units**	**Value**	**Units**
COCs							
3-Methylcholoanthrene	2.20E+01	$(mg/kg\text{-}day)^{-1}$	1	2.20E+01	$(mg/kg\text{-}day)^{-1}$	--	Unitless
Benzo(a)pyrene	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1	7.30E+00	$(mg/kg\text{-}day)^{-1}$	0.13	Unitless
Aroclor 1260	2.0E+00	$(mg/kg\text{-}day)^{-1}$	1	2.0E+00	$(mg/kg\text{-}day)^{-1}$	0.14	Unitless

Table 1.G
Human Health Risk-Based Cleanup Values - Lower Ley Creek Soil
Younger Recreational Recreational Visitor (< 6 years)

Younger Child Recreational Visitor (< 6 years)				
Constituent	**Soil EPC Utilized in HHRA**	***Proposed Cleanup Value (mg/kg)***	**Target Organ**	**Receptor Scenario Hazard Index**
Non-Cancer Risk				
3-Methylcholanthrene	5.7	--	--	--
Benzo(a)pyrene	8.888	--	--	--
Dibenzo(a,h)anthracene	0.73	--	--	--
Aroclor 1260	18	*0.59*	Whole Body	1
Vanadium		*13*	Kidneys	1
Cancer Risk				
3-Methylcholanthrene	5.7	*0.15*	--	1.E-05
Benzo(a)pyrene	8.888	*0.066*	--	1.E-05
Dibenzo(a,h)anthracene	0.73	*0.066*	--	1.E-05
Aroclor 1260	18	*1.7*	--	1.E-05
Vanadium		--	--	1.E-05

Exposure Parameters Utilized in HHRA			
Parameter	**Definition**	**Units**	**Value**
CF	Unit Conversion Factor for Soil	kg/mg	0.000001
IR	Ingestion Rate of Soil	mg/day	200
FI	Fraction Ingested from Soil	unitless	1
EF	Exposure Frequency	days/year	143
ED	Exposure Duration	years	6
SA	Skin Surface Area for Dermal Absorption	cm^2/day	2,800
AF	Soil to Skin Adherence Factor	mg/cm^2	2.8
BW	Body Weight	kg	15
AT-NC	Averaging Time - Non-Cancer	days	2,190
AT-C	Averaging Time - Cancer	days	25,550
IRS-S-Adj (0-2 years)	Age-Adjusted Ingestion Rate of Soil	mg-yr/day-kg	39.7
IRS-S-Adj (2-6 years)	Age-Adjusted Ingestion Rate of Soil	mg-yr/day-kg	49.8
SSAF-Adj (0-2 years)	Age-Adjusted Soil to Skin Adherence Factor	mg-yr/day-kg	1,702.7
SSAF-Adj (2-6 years)	Age-Adjusted Soil to Skin Adherence Factor	mg-yr/day-kg	2,375.3
Ingestion Intake Multiplier - Non-Cancer		day^{-1}	5.22374E-06
Dermal Intake Multiplier - Non-Cancer		day^{-1}	0.000204771
Ingestion Intake Multiplier - Cancer		day^{-1}	4.48E-07
Dermal Intake Multiplier - Cancer		day^{-1}	1.76E-05

Chemical-Specific Parameters Utilized in HHRA - Non-Cancer							
Chemical of Potential Concern	**Oral RfD**		**Oral Absorption Efficiency for Dermal (unitless)**	**Absorbed RfD for Dermal**		**Dermal Absorption Factor**	
	Value	**Units**		**Value**	**Units**	**Value**	**Units**
PCBs							
3-Methylcholanthrene	--	mg/kg-day	1	--	mg/kg-day	--	Unitless
Benzo(a)pyrene	--	mg/kg-day	1	--	mg/kg-day	0.13	Unitless
Dibenzo(a,h)anthracene	--	mg/kg-day	1	--	mg/kg-day	0.13	Unitless
Aroclor 1260	2.0E-05	mg/kg-day	1	2.0E-05	mg/kg-day	0.14	Unitless
Vanadium	7.0E-05	mg/kg-day	0.026	1.8E-06	mg/kg-day	--	Unitless
Chemical-Specific Parameters Utilized in HHRA - Cancer							
Chemical of Potential Concern	**Oral CSF**		**Oral Absorption Efficiency for Dermal (unitless)**	**Absorbed CSF for Dermal**		**Dermal Absorption Factor**	
	Value	**Units**		**Value**	**Units**	**Value**	**Units**
PCBs							
3-Methylcholanthrene	2.20E+01	$(mg/kg\text{-}day)^{-1}$	1	2.20E+01	$(mg/kg\text{-}day)^{-1}$	--	Unitless
Benzo(a)pyrene	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1	7.30E+00	$(mg/kg\text{-}day)^{-1}$	0.13	Unitless
Dibenzo(a,h)anthracene	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1	7.30E+00	$(mg/kg\text{-}day)^{-1}$	0.13	Unitless
Aroclor 1260	2.0E+00	$(mg/kg\text{-}day)^{-1}$	1	2.0E+00	$(mg/kg\text{-}day)^{-1}$	0.14	Unitless
Vanadium	--	$(mg/kg\text{-}day)^{-1}$	0.026	--	$(mg/kg\text{-}day)^{-1}$	--	Unitless

Table 1.H
Human Health Risk-Based Cleanup Values - Lower Ley Creek Fish Tissue
Adult Recreational Visitor (> 16 years)

Adult Recreational Visitor (> 16 years)					
Constituent	**Fish Tissue EPC Utilized in HHRA**	***Proposed Cleanup Value (mg/kg sediment)***	***Proposed Cleanup Value (mg/kg fish tissue)***	**Target Organ**	**Receptor Scenario Hazard Index**
Non-Cancer Risk					
Aroclor-1254	1.179	*0.0027*	*0.028*	Whole Body	0.5
Aroclor-1260	0.58	*0.30*	*0.028*	Whole Body	0.5
Total Aroclors	1.348	--	--	--	--
Total D/F, as TEQ	3.47E-06	*0.00023*	*2.0E-06*	Reproduction/ Thyroid in Neonates	1
Dieldrin	0.0167	*0.36*	*0.14*	Liver	1
Arsenic	1.419	*33.9*	*0.84*	Skin	1
Chromium	43.68	*3999*	*8.4*	Gastrointestinal	1
Mercury	0.478	*2.44*	*0.28*	Developmental	1
Cancer Risk					
Aroclor-1254	1.179	--	--	--	--
Aroclor-1260	0.58	--	--	--	--
Total Aroclors	1.348	*0.49*	*0.033*	--	1.E-05
Total D/F, as TEQ	3.47E-06	*5.09E-05*	*4.4E-07*	--	1.E-05
Dieldrin	0.0167	*0.011*	*0.0041*	--	1.E-05
Arsenic	1.419	*1.76*	*0.044*	--	1.E-05
Chromium	43.68	*62.2*	*0.13*	--	1.E-05
Mercury	0.478	--	--	--	1.E-05

Exposure Parameters Utilized in HHRA			
Parameter	**Definition**	**Units**	**Value**
CF	Unit Conversion Factor for Fish Tissue	kg/g	0.001
IR	Ingestion Rate of Fish Tissue	g fish/day	25
FI	Fraction Ingested from Fish Tissue	unitless	1
EF	Exposure Frequency	days/year	365
ED	Exposure Duration	years	30
BW	Body Weight	kg	70
AT-NC	Averaging Time - Non-Cancer	days	10,950
AT-C	Averaging Time - Cancer	days	25,550
Ingestion Intake Multiplier - Non-Cancer		day^{-1}	3.57E-04
Ingestion Intake Multiplier - Cancer		day^{-1}	1.53E-04

Chemical-Specific Parameters Utilized in HHRA - Non-Cancer		
Chemical of Potential Concern	**Oral RfD**	
	Value	**Units**
COCs		
Aroclor-1254	2.0E-05	mg/kg-day
Aroclor-1260	2.0E-05	mg/kg-day
Total Aroclors	2.0E-05	mg/kg-day
Total D/F, as TEQ	7.0E-10	mg/kg-day
Dieldrin	5.0E-05	mg/kg-day
Arsenic	3.0E-04	mg/kg-day
Chromium	3.0E-03	mg/kg-day
Mercury	1.0E-04	mg/kg-day
Chemical-Specific Parameters Utilized in HHRA - Cancer		
Chemical of Potential Concern	**Oral CSF**	
	Value	**Units**
COCs		
Aroclor-1254	2.00E+00	$(mg/kg\text{-}day)^{-1}$
Aroclor-1260	2.00E+00	$(mg/kg\text{-}day)^{-1}$
Total Aroclors	2.00E+00	$(mg/kg\text{-}day)^{-1}$
Total D/F, as TEQ	1.50E+05	$(mg/kg\text{-}day)^{-1}$
Dieldrin	1.60E+01	$(mg/kg\text{-}day)^{-1}$
Arsenic	1.50E+00	$(mg/kg\text{-}day)^{-1}$
Chromium	0.5	$(mg/kg\text{-}day)^{-1}$
Mercury	--	$(mg/kg\text{-}day)^{-1}$

	Fish Concentration UCL (mg/kg)	**Sediment Concentration UCL (mg/kg)**	**BSAF**
Aroclor-1254	0.2446	0.024	10.19166667
Aroclor-1260	0.1013	1.093	0.092680695
Total Aroclors	0.3125	4.645	0.067276642
Total D/F, as TEQ	0.000048	0.00561	0.00855615
Dieldrin	0.00363	0.0094	0.386170213
Arsenic	0.21	8.4647	0.024808912
Chromium	0.36	171.3727	0.002100685
Mercury	0.04	0.3481	0.114909509

Table 1.I
Human Health Risk-Based Cleanup Values - Lower Ley Creek Fish Tissue
Older Child Recreational Visitor (6 to 16 years)

Older Child Recreational Visitor (6 to 16 years)					
Constituent	**Fish Tissue EPC Utilized in HHRA**	***Proposed Cleanup Value (mg/kg sediment)***	***Proposed Cleanup Value (mg/kg fish tissue)***	**Target Organ**	**Receptor Scenario Hazard Index**
Non-Cancer Risk					
Aroclor-1254	1.179	*0.0034*	*0.035*	Whole Body	0.5
Aroclor-1260	0.58	*0.37*	*0.035*	Whole Body	0.5
Total Aroclors	1.348	--	--	--	--
Total D/F, as TEQ	3.47E-06	*2.84E-04*	*2.4E-06*	Reproduction/ Thyroid in Neonates	1
Dieldrin	0.0167	*0.45*	*0.17*	Liver	1
Arsenic	1.419	*42*	*1.0*	Skin	1
Chromium	43.68	*4960*	*10*	Gastrointestinal	1
Mercury	0.478	*3.0*	*0.35*	Developmental	1
Cancer Risk					
Aroclor-1254	1.179	--	--	--	--
Aroclor-1260	0.58	--	--	--	--
Total Aroclors	1.348	*1.8*	*0.12*	--	1.E-05
Total D/F, as TEQ	3.47E-06	*1.89E-04*	*1.6E-06*	--	1.E-05
Dieldrin	0.0167	*0.039*	*0.015*	--	1.E-05
Arsenic	1.419	*6.5*	*0.16*	--	1.E-05
Chromium	43.68	*77*	*0.16*	--	1.E-05
Mercury	0.478	--	--	--	1.E-05

Exposure Parameters Utilized in HHRA			
Parameter	**Definition**	**Units**	**Value**
CF	Unit Conversion Factor for Fish Tissue	kg/g	0.001
IR	Ingestion Rate of Fish Tissue	g fish/day	16.7
FI	Fraction Ingested from Fish Tissue	unitless	1
EF	Exposure Frequency	days/year	365
ED	Exposure Duration	years	10
BW	Body Weight	kg	58
AT-NC	Averaging Time - Non-Cancer	days	3,650
AT-C	Averaging Time - Cancer	days	25,550
Ingestion Intake Multiplier - Non-Cancer		day^{-1}	2.88E-04
Ingestion Intake Multiplier - Cancer		day^{-1}	4.11E-05

Chemical-Specific Parameters Utilized in HHRA - Non-Cancer		
Chemical of Potential Concern	**Oral RfD**	
	Value	**Units**
COCs		
Aroclor-1254	2.0E-05	mg/kg-day
Aroclor-1260	2.0E-05	mg/kg-day
Total Aroclors	2.0E-05	mg/kg-day
Total D/F, as TEQ	7.0E-10	mg/kg-day
Dieldrin	5.0E-05	mg/kg-day
Arsenic	3.0E-04	mg/kg-day
Chromium	3.0E-03	mg/kg-day
Mercury	1.0E-04	mg/kg-day
Chemical-Specific Parameters Utilized in HHRA - Cancer		
Chemical of Potential Concern	**Oral CSF**	
	Value	**Units**
COCs		
Aroclor-1254	2.00E+00	$(mg/kg\text{-}day)^{-1}$
Aroclor-1260	2.00E+00	$(mg/kg\text{-}day)^{-1}$
Total Aroclors	2.00E+00	$(mg/kg\text{-}day)^{-1}$
Total D/F, as TEQ	1.50E+05	$(mg/kg\text{-}day)^{-1}$
Dieldrin	1.60E+01	$(mg/kg\text{-}day)^{-1}$
Arsenic	1.50E+00	$(mg/kg\text{-}day)^{-1}$
Chromium*	0.5	$(mg/kg\text{-}day)^{-1}$
Mercury	--	$(mg/kg\text{-}day)^{-1}$

*The age-dependent adjustment factor was used to account for mutagenic effects.

	Fish Concentration UCL (mg/kg)	**Sediment Concentration UCL (mg/kg)**	**BSAF**
Aroclor-1254	0.2446	0.024	10.19166667
Aroclor-1260	0.1013	1.093	0.092680695
Total Aroclors	0.3125	4.645	0.067276642
Total D/F, as TEQ	0.000048	0.00561	0.00855615
Dieldrin	0.00363	0.0094	0.386170213
Arsenic	0.21	8.4647	0.024808912
Chromium	0.36	171.3727	0.002100685
Mercury	0.04	0.3481	0.114909509

Table 1.J
Human Health Risk-Based Cleanup Values - Lower Ley Creek Fish Tissue
Younger Child Recreational Visitor (< 6 years)

Younger Child Recreational Visitor (< 6 years)					
Constituent	**Fish Tissue EPC Utilized in HHRA**	**Proposed Cleanup Value (mg/kg sediment)**	**Proposed Cleanup Value (mg/kg fish tissue)**	**Target Organ**	**Receptor Scenario Hazard Index**
Non-Cancer Risk					
Aroclor-1254	1.179	*0.0018*	*0.018*	Whole Body	0.5
Aroclor-1260	0.58	*0.19*	*0.018*	Whole Body	0.5
Total Aroclors	1.348	--	--	--	--
Total D/F, as TEQ	3.47E-06	*0.00015*	*1.3E-06*	Reproduction/ Thyroid in Neonates	1
Dieldrin	0.0167	*0.23*	*0.09*	Liver	1
Arsenic	1.419	*22*	*0.54*	Skin	1
Chromium	43.68	*2581*	*5.4*	Gastrointestinal	1
Mercury	0.478	*1.6*	*0.18*	Developmental	1
Cancer Risk					
Aroclor-1254	1.179	--	--	--	--
Aroclor-1260	0.58	--	--	--	--
Total Aroclors	1.348	*1.6*	*0.11*	--	1.E-05
Total D/F, as TEQ	3.47E-06	*0.00016*	*1.4E-06*	--	1.E-05
Dieldrin	0.0167	*0.034*	*0.013*	--	1.E-05
Arsenic	1.419	*5.7*	*0.14*	--	1.E-05
Chromium	43.68	*38*	*0.079*	--	1.E-05
Mercury	0.478	--	--	--	1.E-05

Exposure Parameters Utilized in HHRA			
Parameter	**Definition**	**Units**	**Value**
CF	Unit Conversion Factor for Fish Tissue	kg/g	0.001
IR	Ingestion Rate of Fish Tissue	g fish/day	8.3
FI	Fraction Ingested from Fish Tissue	unitless	1
EF	Exposure Frequency	days/year	365
ED	Exposure Duration	years	6
BW	Body Weight	kg	15
AT-NC	Averaging Time - Non-Cancer	days	2,190
AT-C	Averaging Time - Cancer	days	25,550
Ingestion Intake Multiplier - Non-Cancer		day^{-1}	5.53E-04
Ingestion Intake Multiplier - Cancer		day^{-1}	4.74E-05

Chemical-Specific Parameters Utilized in HHRA - Non-Cancer		
Chemical of Potential Concern	**Oral RfD**	
	Value	**Units**
COCs		
Aroclor-1254	2.0E-05	mg/kg-day
Aroclor-1260	2.0E-05	mg/kg-day
Total Aroclors	2.0E-05	mg/kg-day
Total D/F, as TEQ	7.0E-10	mg/kg-day
Dieldrin	5.0E-05	mg/kg-day
Arsenic	3.0E-04	mg/kg-day
Chromium	3.0E-03	mg/kg-day
Mercury	1.0E-04	mg/kg-day
Chemical-Specific Parameters Utilized in HHRA - Cancer		
Chemical of Potential Concern	**Oral CSF**	
	Value	**Units**
COCs		
Aroclor-1254	2.00E+00	$(mg/kg\text{-}day)^{-1}$
Aroclor-1260	2.00E+00	$(mg/kg\text{-}day)^{-1}$
Total Aroclors	2.00E+00	$(mg/kg\text{-}day)^{-1}$
Total D/F, as TEQ	1.50E+05	$(mg/kg\text{-}day)^{-1}$
Dieldrin	1.60E+01	$(mg/kg\text{-}day)^{-1}$
Arsenic	1.50E+00	$(mg/kg\text{-}day)^{-1}$
Chromium*	0.5	$(mg/kg\text{-}day)^{-1}$
Mercury	--	$(mg/kg\text{-}day)^{-1}$

*The age-dependent adjustment factors were used to account for mutagenic effects.

	Fish Concentration UCL (mg/kg)	**Sediment Concentration UCL (mg/kg)**	**BSAF**
Aroclor-1254	0.2446	0.024	10.19166667
Aroclor-1260	0.1013	1.093	0.092680695
Total Aroclors	0.3125	4.645	0.067276642
Total D/F, as TEQ	0.000048	0.00561	0.00855615
Dieldrin	0.00363	0.0094	0.386170213
Arsenic	0.21	8.4647	0.024808912
Chromium	0.36	171.3727	0.002100685
Mercury	0.04	0.3481	0.114909509

Table 2
Ecological Risk-based Cleanup Values
Summary Tables

Lower Ley Creek - Ecological PRGs - Sediment										
CAS Number	**Constituent**	**Lower Ley Creek Sediment EPC utilized in BERA**	**New York Sediment Criteria Metals[d] (mg/kg)**	**New York Sediment Criteria Benthic Aquatic Life Chronic Toxicity[e] (mg/kg in sediment)**	**New York Sediment Criteria Wildlife Bioaccumulation[e] (mg/kg in sediment)**	**Proposed Lower Ley Creek Sediment PRG for Belted Kingfisher (LOAEL Based)**	**Proposed Lower Ley Creek Sediment PRG for Belted Kingfisher (NOAEL Based)**	**Proposed Lower Ley Creek Sediment PRG for Mink (LOAEL Based)**	**Proposed Lower Ley Creek Sediment PRG for Mink (NOAEL Based)**	**Proposed Lower Ley Creek Sediment PRG for Benthic Invertebrates**
COCs										
7440-38-2	Arsenic	19	6	--	--	--	--	--	--	5.6
7440-43-9	Cadmium	107	0.6	--	--	--	--	--	--	6.4
7440-47-3	Chromium	1090	26	--	--	--	--	--	--	94.2
7440-50-8	Copper	433	16	--	--	--	--	--	--	102
7439-92-1	Lead	284	31	--	--	--	--	--	--	87.8
7439-97-6	Mercury	1.3	0.15	--	--	--	--	--	--	0.29
7440-02-0	Nickel	447	16	--	--	--	--	--	--	34.4
7440-22-4	Silver	18	1	--	--	--	--	--	--	2.1
7440-66-6	Zinc	1640	120	--	--	229	26	--	--	342
22967-92-6	Methylmercury	0.3481	--	--	--	0.12	0.012	0.11	0.011	--
1746-01-6	Dioxins/Furans, as TEQ	0.00561	--	--	--	0.0018	0.00018	0.00029	0.000029	--
11097-69-1	Aroclor 1254	0.024	--	19.3	1.4	--	--	0.01	0.0011	--
11096-82-5	Aroclor 1260	1.093	--	19.3	1.4	--	--	0.009	0.0009	--
--	Total PCBs	4.645	--	19.3	1.4	--	--	0.12	0.012	--
--	Total PAHs	164[a], 451.9[b], 249.2[c]	--	73[f]	--	314	31	--	--	45.19

Notes:
All values in mg/kg.
EPC = Exposure Point Concentration.
PRG = Preliminary Remdiation Goal.
[a] = Sediment EPC used in upper level receptor food web.
[b] = Maximum sediment concentration of high molecular weight PAHs used in benthic invertebrate and plant benchmark screening.
[c] = Maximum sediment concentration of low molecular weight PAHs used in benthic invertebrate and plant benchmark screening.
[d] = Metals sediment screening values are the "Lowest Effect Levels" obtained from Table 2: Sediment Criteria for Metals in "Technical Guidance for Screening Contaminated Sediments, New York State Department of Environmental Conservation, January 1999."
[e] = Organic sediment screening values obtained from Table 1: Sediment Criteria for Non-polar Organic Compounds in "Technical Guidance for Screening Contaminated Sediments, New York State Department of Environmental Conservation, January 1999."
[f] = listed value is the lowest sediment screening value associated with PAHs (fluorene).
= lowest proposed PRG.

Table 2.A
Ecological Risk-based Cleanup Values - Ley Creek Sediment

Mink																
CAS Number	**Constituent**	**Ley Creek Surface Water EPC Utilized in BERA**	**Sediment EPC Utilized in BERA (mg/kg)**	***Proposed LOAEL Based Cleanup Value (mg/kg)***	***Proposed NOAEL Based Cleanup Value (mg/kg)***	**Surface Water Dose**	**Sediment Dose**	**Site-Specific Uptake Factor (Fish)**	**Prey Concentration-Fish (Estimated)**	**Prey Dose**	**Total Daily Intake-LOAEL Based PRG**	**Total Daily Intake-NOAEL Based PRG**	**TRV (Mammalian-LOAEL)**	**LOAEL Based HQ**	**TRV (Mammalian-NOAEL)**	**NOAEL Based HQ**
COCs																
22967-92-6	Methylmercury	0.0001	0.3481	0.67	0.067	0.0000104	0.00050	0.115	0.076989371	0.02414	0.025	0.002	0.025	0.986	0.0025	0.990
1746-01-6	Dioxins/Furans, as TEQ	NV	0.00561	0.0029	0.00029	NV	0.0000022	0.009	2.48128E-05	0.00001	0.000010	0.000	0.00001	0.995	0.000001	0.995
11097-69-1	Aroclor 1254	NV	0.024	0.026	0.0031	NV	0.00002	10.192	0.264983333	0.08307	0.083	0.010	0.1	0.831	0.01	0.991
11096-82-5	Aroclor 1260	NV	1.093	1.1	0.11	NV	0.00083	0.093	0.101948765	0.03196	0.033	0.003	0.034	0.964	0.0034	0.964
--	Total PCBs	NV	4.645	1.5	0.15	NV	0.00113	0.067	0.101	0.03164	0.033	0.003	0.034	0.964	0.0034	0.964

Belted Kingfisher																
CAS Number	**Constituent**	**Ley Creek Surface Water EPC Utilized in BERA**	**Sediment EPC Utilized in BERA (mg/kg)**	***Proposed LOAEL Based Cleanup Value (mg/kg)***	***Proposed NOAEL Based Cleanup Value (mg/kg)***	**Surface Water Dose**	**Sediment Dose**	**Site-Specific Uptake Factor (Fish)**	**Prey Concentration-Fish (Estimated)**	**Prey Dose**	**Total Daily Intake-LOAEL Based PRG**	**Total Daily Intake-NOAEL Based PRG**	**TRV (Avian-LOAEL)**	**LOAEL Based HQ**	**TRV (Mammalian-NOAEL)**	**NOAEL Based HQ**
COCs																
22967-92-6	Methylmercury	0.0001	0.3481	1.1	0.11	0.000011	0.00128	0.11	0.13	0.05904	0.06	0.01	0.064	0.943	0.0064	0.944
1746-01-6	Dioxins/Furans, as TEQ	NV	0.00561	0.027	0.0027	NV	0.0000315	0.01	0.00	0.00011	0.00014	0.000014	0.00014	0.996	0.000014	0.996
--	Total PAHs	NV	164.314	1220	122	NV	1.42	NV	NV	NV	1.42	0.14	1.43	0.996	0.143	0.996
7440-66-6	Zinc	NV	181.055	1550	171	NV	1.81	0.18	276.52	129.15214	130.96	14.45	131	1.000	14.5	0.996

Life History Parameters as Presented in BERA			
Life History Data	**Units**	**Mink**	**Belted Kingfisher**
		Mustela vison	***Ceryle alcyon***
Body Weight	kg	0.600	0.136
Food Ingestion Rate (dry weight basis)	kg DW/kg BW-day	0.08	0.12
Percent Dry Matter in Diet	%	24	25
Food Ingestion Rate (wet weight basis)	kg WW/kg BW-day	0.313	0.467
Water Ingestion Rate	kg/kg BW-day	0.10	0.11
Time & Area Use Factor	unitless	1.0	1.0
Territory size	km or ha	1 - 5 (km)	0.39-2.19 (km)
Percent Diet Composition			
Aquatic Food Item			
Aquatic invertebrates	%	-	-
Fish	%	1.00	1.00
Sediment Ingestion Rate Information			
Fraction of diet that is soil/sediment	% (DW basis)	1.0	1.0
Soil/Sediment ingestion rate	kg DW/kg BW-day	0.00075	0.00117

Prey Concentration - Fish (Measured) (mg/kg)	
Methylmercury	0.04
Dioxins/Furans, as TEQ	0.000048
Aroclor 1254	0.2446
Aroclor 1260	0.1013
Total PCBs	0.3125
PAHs	NV
Zinc	32.3

Notes:

All values in mg/kg

NA = Compound did not result in HQ > 1 for this receptor in corresponding risk assessment.

NV = Not a COC for this media.

* Value represents sediment EPC corresponding to a HQ less than one, given risk assessment model parameters and assumptions. HQ determined via use of NOAEL.

Cleanup value determined assuming body burden from surface water remains identical to that presented in BERA (i.e. surface water not remediated).

Table 2.B
Ecological Risk-based Cleanup Values
Lower Ley Creek Sediment
Benthic Invertebrates

Sediment PRGs - Benthic Invertebrates			
CAS Number	Constituent	Concentration Used in Benchmark Screening for Benthic Invertebrates (Maximum Concentration) (mg/kg)	Proposed PRG (Maximum No Effect Concentration via Toxicity Testing) (mg/kg)
COCs			
7440-38-2	Arsenic	19	5.6
7440-43-9	Cadmium	107	6.4
7440-47-3	Chromium	1090	94.2
7440-50-8	Copper	433	102
7439-92-1	Lead	284	87.8
7439-97-6	Mercury	1.3	0.29
7440-02-0	Nickel	447	34.4
7440-22-4	Silver	18	2.1
7440-66-6	Zinc	1640	342
--	Total PAHs	451.9[a], 249.2[b]	45.19

Notes:

[a] = High molecular weight PAHS

[b] = Low molecular weight PAHs

Table 2.C
Ecological Risk Benchmark Screening
Lower Ley Creek Soil
Benthic Invertebrates

Analyte	EPA Eco-SSL				New York Soil Cleanup Objectives-Protection of Ecological Resources	EPA Region 5 Ecological Soil Screening Levels	Maximum Detected Value[a] (mg/kg)
	Plants	Terrestrial Invertebrates	Birds	Mammals			
2-Methylnaphthalene	Based on sum of low molecular weight PAHs				--	--	2.51
Acenaphthene					--	--	2.25
Acenaphthylene					--	--	7.84
Anthracene					--	--	14.9
Fluoranthene					--	--	61.4
Fluorene					--	--	3.76
Naphthalene					--	--	3.68
Phenanthrene					--	--	28.2
Sum Low Molecular Weight PAHs	NSV	29	NSV	100	--	--	124.54
Benzo(a)anthracene	Based on sum of high molecular weight PAHs				--	--	36.2
Benzo(a)pyrene					--	--	27.4
Benzo(b)fluoranthene					--	--	29.1
Benzo(g,h,i)perylene					--	--	16
Benzo(k)fluoranthene					--	--	20.9
Chrysene					--	--	36.7
Dibenzo(a,h)anthracene					--	--	6.4
Indeno(1,2,3-cd)pyrene					--	--	14.3
Pyrene					--	--	62.2
Sum High Molecular Weight PAHs	NSV	18	NSV	1.1	--	--	249.2
1,4-Dichlorobenzene	--	--	--	--	20	--	0.14
2-Butanone	--	--	--	--	100	--	0.38
4-Methylphenol	--	--	--	--	--	163	0.05
4-Nitroaniline	--	--	--	--	--	21.9	0.06
Acetone	--	--	--	--	2.2	2.5	2.03
Alpha-Chlordane	--	--	--	--	1.3	0.224	0.0493
Aluminum	--	--	--	--	--	--	15300
Antimony	NSV	78	NSV	0.27	--	--	19.6
Arsenic	18	NSV	43	46	--	--	17.4
Barium	NSV	330	NSV	2000	--	--	431
Benzene	--	--	--	--	70	0.255	0.06
Beryllium	NSV	40	NSV	21	--	--	3.61
Bis-(2-ethyhexyl)phthalate	--	--	--	--	--	0.925	0.71
Bromomethane	--	--	--	--	--	0.235	0.002
Butylbenzylphthalate	--	--	--	--	--	0.239	1.1
Cadmium	32	140	0.77	0.36	--	--	337
Carbazole	--	--	--	--	--	--	3.23
Carbon Disulfide	--	--	--	--	--	0.0941	0.05
Chromium	NSV	NSV	26	34	--	--	1320
cis-1,2-Dichloroethene	--	--	--	--	--	--	0.003
Cobalt	13	NSV	120	230	--	--	12.2
Copper	70	80	28	49	--	--	731
Cyanide	--	--	--	--	--	1.33	0.6
Dibenzofuran	--	--	--	--	--	--	2.24
Di-n-butylphthalate	--	--	--	--	--	0.15	0.157
Endrin	--	--	--	--	0.014	0.01	0.084
Gamma-Chlordane	--	--	--	--	--	0.224	0.035
Iron	--	--	--	--	--	--	31100
Isophorone	--	--	--	--	--	139	0.05
Lead	120	1700	11	56	--	--	575
Manganese	220	450	4300	4000	--	--	554
Mercury	--	--	--	--	--	0.1	4.11
Methoxychlor	--	--	--	--	--	0.0199	0.0085
Methylene chloride	--	--	--	--	12	--	0.004
Nickel	38	280	210	130	--	--	434
p,m Xylene	--	--	--	--	0.26	--	0.003
p,p'-DDD	DDT and metabolites				--	--	0.008
p,p'-DDE					--	--	0.492
p,p'-DDT					--	--	0.216
DDT and metabolites	NSV	NSV	0.093	0.021	--	--	0.716
PCB-1248	--	--	--	--	1	--	86.1
PCB-1260	--	--	--	--	1	--	2.94
Phenol	--	--	--	--	30	--	0.0476
Selenium	0.52	4.1	1.2	0.63	--	--	5.2
Silver	560	NSV	4.2	14	--	--	136
Tetrachloroethene	--	--	--	--	2	9.92	0.00384
Toluene	--	--	--	--	36	5.45	0.0183
Trichloroethene	--	--	--	--	2	12.4	0.00918
Vanadium	NSV	NSV	7.8	280	--	--	34.9
Zinc	160	120	46	79	--	--	2180

Notes:

[a] = Maximum detected surface soil (0-2 feet) concentration obtained from the Lower Ley Creek Human Health Risk Assessment, Table 2s.

-- = not available or not applicable

(shaded) Indicates screening level is lower than the Maximum Detected Value.

Table 2.D
Biota-Sediment Accumulation Factors

COC	Mean Fish Tissue Concentration (mg/kg wet wt)	Mean Sediment Concentration (mg/kg)	BSAF (kg sediment/kg fish tissue wet wt)
Methylmercury*	0.04	0.034	1.2
Dioxins/Furans as TEQ**	0.000033	0.0002	0.17
Aroclor 1254**	0.2446	0.0051	48
Aroclor 1260**	0.1013	0.0051	20
Total PCBs*	0.1475	0.102	1.4
PAHs	NA	NA	0
Zinc*	32.3	25.75	1.3

* Results for downstream reach.

** Results for upstream reach.

NA = Not applicable; no tissue concentrations listed in the BERA

Table 2.E
Mink

COC	Surface Water Conc (mg/L)	Surface Water Ingestion Rate (L/kg BW-day)	Surface Water Dose (mg/kg BW-day)	TRV - LOAEL (mg/kg BW-day)	TRV - NOAEL (mg/kg BW-day)	Target LOAEL HQ	Target NOAEL HQ	LOAEL PRG (mg/kg sediment)	NOAEL PRG (mg/kg sediment)
Methylmercury	0.0001	0.104	0.0000104	0.025	0.0025	0.99	1	0.11	0.011
Dioxins/Furans, as TEQ	NA	0.104	NA	1.00E-05	0.000001	0.99	1	0.00029	2.9E-05
Aroclor 1254	NA	0.104	NA	0.1	0.01	0.99	1	0.010	0.0011
Aroclor 1260	NA	0.104	NA	0.034	0.0034	0.99	1	0.009	0.0009
Total PCBs	NA	0.104	NA	0.034	0.0034	0.99	1	0.12	0.012

Surface water concentration obtained from BERA. No remediation of surface water assumed.

NA = Not available; concentrations not provided in BERA.

Sediment Ingestion Rate (kg sed/kg BW-day)

Fish Tissue Ingestion Rate (kg tissue ww/kg BW-day)

Table 2.F
Belted Kingfisher

COC	Surface Water Conc (mg/L)	Surface Water Ingestion Rate (L/kg BW-day)	Surface Water Dose (mg/kg BW-day)	TRV - LOAEL (mg/kg BW-day)	TRV - NOAEL (mg/kg BW-day)	Target LOAEL HQ	Target NOAEL HQ	LOAEL PRG (mg/kg sediment)	NOAEL PRG (mg/kg sediment)
Methylmercury	0.0001	0.114	0.0000114	0.064	0.0064	0.99	1	0.12	0.012
Dioxins/Furans, as TEQ	NA	0.114	NA	0.00014	0.000014	0.99	1	0.0018	0.00018
Total PAHs	0.0127	0.114	0.0014478	1.43	0.143	0.99	1	314	31
Zinc	0.0134	0.114	0.0015276	131	14.5	0.99	1	229	26

Surface water concentration obtained from BERA. No remediation of surface water assumed.

NA = Not available; concentrations not provided in BERA.

Sediment Ingestion Rate (kg sed/kg BW-day)

Fish Tissue Ingestion Rate (kg tissue ww/kg BW-day)

APPENDIX C

Remedial Alternative Cost Estimates

Table C-1
Lower Ley Creek
Soil Remedial Alternative Cost Estimates (On-site Disposal)

Description			Alternative Soil-1 No Action		Alternative Soil-2 Excavation of Soil to Meet Cleanup Goals		Alternative Soil-3 Excavation of Southern Swale Soils to Meet Cleanup Goals and Soil Cap for Northwest Soils		Alternative Soil-4 Soil Cap Over All Contaminated Soils	
Cost Item	**Units**	**Unit Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**
Construction Activities										
General Site Mobilization	**LS**	**$ 40,000**	0	$ -	1	$ 40,000	1	$ 40,000	1	$ 40,000
Excavate Soils	**CY**	**$ 15**	0	$ -	75,239	$ 1,128,585	73,997	$ 1,109,955	63,865	$ 957,975
Transport and Dispose of Material Onsite (Non-TSCA)	**ton**	**$ 5**	0	$ -	85,772	$ 428,862	84,357	$ 421,783	72,806	$ 364,031
Transport and Dispose of Material Offsite (0-50 ppm)	**ton**	**$ 75**	0	$ -	0	$ -	0	$ -	0	$ -
Transport and Dispose of Material Offsite (50-500 ppm)	**ton**	**$ 225**	0	$ -	0	$ -	0	$ -	0	$ -
Transport and Dispose of Material Offsite (500 ppm +)	**ton**	**$ 369**	0		4,514	$ 1,665,791	4,440	$ 1,638,294	3,832	$ 1,413,971
Cultural Study	**hour**	**$ 100.00**	0	$ -	500	$ 50,000	500	$ 50,000	500	$ 50,000
Wetland/Habitat Restoration	**SF**	**$ 0.35**	0	$ -	892,071	$ 312,225	892,071	$ 312,225	892,071	$ 312,225
1-Foot Soil Capping	**SF**	**$ 1.00**	0	$ -	66,034	$ 66,034	72,736	$ 72,736	134,576	$ 134,576
Backfill Soil/Habitat Layer	**CY**	**$ 30.00**	0	$ -	75,239	$ 2,257,170	73,749	$ 2,212,470	61,326	$ 1,839,780
Sub-Total Construction Costs				$ -		**$ 5,948,668**		**$ 5,857,462**		**$ 5,112,557**
Contingency	**15%**			$ -		$ 892,300		$ 878,619		$ 766,884
Total Construction Cost				**$ -**		**$ 6,840,968**		**$ 6,736,082**		**$ 5,879,441**
Professional and Technical Services										
Engineering	**10%**			$ -		$ 684,097		$ 673,608		$ 587,944
Construction Management	**20%**			$ -		$ 1,368,194		$ 1,347,216		$ 1,175,888
Project Management	**10%**			$ -		$ 889,326		$ 875,691		$ 764,327
Sub-Total Professional and Technical Services				$ -		**$ 2,941,616**		**$ 2,896,515**		**$ 2,528,160**
Annual Operation and Maintenance										
Soil Cap Maintenance and Habitat Restoration Monitoring	**yr**	**$ 5,000**	0	$ -	1	$ 5,000	1	$ 5,000	1	$ 5,000
General Reporting & Management	**yr**	**$ 10,000**	0	$ -	1	$ 10,000	1	$ 10,000	1	$ 10,000
Sub-Total Annual Operation and Maintenance				**$ -**		**$ 15,000**		**$ 15,000**		**$ 15,000**
Periodic Costs										
5 year Review	**5 yr**	**$ 20,000**	1	$ 20,000	0	$ -	1	$ 20,000	1	$ 20,000
Sub-Total Periodic Costs				**$ 20,000**		**$ -**		**$ 20,000**		**$ 20,000**
Total Capital Costs (Construction, Professional and Technical Services)				$ -		$ 9,782,584		$ 9,632,597		$ 8,407,601
Total Annual Cost (O&M and Periodic Costs)				$ 4,000		$ 15,000		$ 19,000		$ 19,000
Estimated O & M Duration	**yr**			30		30		30		30
Discount Rate	**7%**									
Present Value (of Annual Costs)				$49,636		$186,136		$235,772		$235,772
Total Project Net Present Value				**$49,636**		**$9,968,720**		**$9,868,369**		**$8,643,373**

Notes:
LS- Lump Sum
ft - feet
CY - cubic yard

Table C-2
Lower Ley Creek
Sediment Remedial Alternative Cost Estimates (On-site Disposal)

Description			Alternative Sediment-1 No Action		Alternative Sediment-2 Removal of Sediment to Cleanup Goals		Alternative Sediment-3 Granular Material Sediment Cap		Alternative Sediment-4 Engineered Bentonite Sediment Cap		Alternative Sediment-5 Monitored Natural Recovery	
Cost Item	**Units**	**Unit Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**
Construction Activities												
General Site Mobilization	**LS**	**$ 40,000**	0	$ -	1	$ 40,000	1	$ 40,000	1	$ 40,000	0	$ -
Sediment Conditioning Area Construction	**LS**	**$ 60,000**	0	$ -	1	$ 60,000	1	$ 60,000	1	$ 60,000	0	$ -
Excavation Equipment Mobilization	**LS**	**$ 40,000**	0	$ -	1	$ 40,000	1	$ 40,000	1	$ 40,000	0	$ -
Shallow Excavation from Shore	**CY**	**$ 15**	0	$ -	72,724	$ 1,090,860	56,649	$ 849,735	39,578	$ 593,670	0	$ -
Backfill Sediments/Habitat Layer	**CY**	**$ 30**	0	$ -	19,192	$ 575,760	36,450	$ 1,093,500	35,467	$ 1,064,010	0	$ -
Dewater/ Condition Sediments	**CY**	**$ 5**	0	$ -	72,724	$ 363,620	56,649	$ 283,245	39,578	$ 197,890	0	$ -
Transport and Dispose of Material Onsite (Non-TSCA)	**ton**	**$ 5**	0	$ -	82,905	$ 414,527	64,580	$ 322,899	45,119	$ 225,595	0	$ -
Transport and Dispose of Material Offsite (0-50 ppm)	**ton**	**$ 75**	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -
Transport and Dispose of Material Offsite (50-500 ppm)	**ton**	**$ 225**	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -
Transport and Dispose of Material Offsite (500 ppm +)	**ton**	**$ 369**	0		4,363	$ 1,610,109	3,399	$ 1,254,209	2,375	$ 876,257	0	$ -
Water Treatment Costs	**gal**	**$ 1**	0	$ -	363,620	$ 363,620	283,245	$ 283,245	197,890	$ 197,890	0	$ -
Granular Material Cap	**CY**	**$ 30.00**	0	$ -	0	$ -	12,463	$ 373,890	0	$ -	0	$ -
3-in Bentonite Cap (freshwater formulation) and 3-in sand layer	**SF**	**$ 3.89**	0	$ -	0	$ -	0	$ -	443,956	$ 1,726,989	0	$ -
Armor Stone, Large Riprap Rock Cover	**CY**	**$ 53.79**	0	$ -	0	$ -	8,851	$ 476,095	0	$ -	0	$ -
Armor Stone, Medium Riprap Rock Cover	**CY**	**$ 53.11**	0	$ -	0	$ -	903	$ 47,958	0	$ -	0	$ -
Sub-Total Construction Costs				$ -		**$ 4,558,496**		**$ 5,124,777**		**$ 5,022,300**		**$ -**
Contingency	**15%**			$ -		$ 683,774		$ 768,717		$ 753,345		$ -
Total Construction Cost				$ -		**$ 5,242,271**		**$ 5,893,493**		**$ 5,775,645**		**$ -**
Professional and Technical Services												
Engineering	**10%**			$ -		$ 524,227		$ 589,349		$ 577,565		$ -
Construction Management	**20%**			$ -		$ 1,048,454		$ 1,178,699		$ 1,155,129		$ -
Project Management	**10%**			$ -		$ 681,495		$ 766,154		$ 750,834		$ -
Sub-Total Professional and Technical Services				$ -		**$ 2,254,176**		**$ 2,534,202**		**$ 2,483,528**		**$ -**

Table C-2 Continued
Lower Ley Creek
Sediment Remedial Alternative Cost Estimates (On-site Disposal)

Description			Alternative Sediment-1 No Action		Alternative Sediment-2 Removal of Sediment to Cleanup Goals		Alternative Sediment-3 Granular Material Sediment Cap		Alternative Sediment-4 Engineered Bentonite Sediment Cap		Alternative Sediment-5 Monitored Natural Recovery	
Cost Item	**Units**	**Unit Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**
Annual Operation and Maintenance												
MNR Sampling	**yr**	**$ 100,000**		$ -	0	$ -	1	$ 100,000	1	$ 100,000	1	$ 100,000
MNR Reporting	**yr**	**$ 30,000**			0	$ -	1	$ 30,000	1	$ 30,000	1	$ 30,000
Sediment Cap Maintenance	**yr**	**$ 30,000**			0	$ -	1	$ 30,000	1	$ 30,000	0	$ -
General Reporting & Management	**yr**	**$ 10,000**		$ -	1	$ 10,000	1	$ 10,000	1	$ 10,000	1	$ 10,000
Sub-Total Annual Operation and Maintenance				$ -		**$ 10,000**		**$ 170,000**		**$ 170,000**		**$ 140,000**
Periodic Costs												
5 year Review	**5 yr**	**$ 20,000**	1	$ 20,000	0	$ -	1	$ 20,000	1	$ 20,000	1	$ 20,000
5 year Fish Sampling	**5 yr**	**$ 75,000**	0	$ -	1	$ 75,000	1	$ 75,000	1	$ 75,000	1	$ 75,000
Sub-Total Periodic Costs				**$ 20,000**		**$ 75,000**		**$ 95,000**		**$ 95,000**		**$ 95,000**
Total Capital Costs (Construction, Professional and Technical Services)				$ -		$ 7,496,447		$ 8,427,695		$ 8,259,173		$ -
Total Annual Cost (O&M and Periodic Costs)				$ 4,000		$ 25,000		$ 189,000		$ 189,000		$ 159,000
Estimated O & M Duration	**yr**			30		30		30		30		30
Discount Rate	**7%**											
Present Value (of Annual Costs)				$49,636		$310,226		$2,345,309		$2,345,309		$1,973,038
Total Project Net Present Value				**$49,636**		**$7,806,673**		**$10,773,004**		**$10,604,482**		**$1,973,038**

Notes:
LS- Lump Sum
ft - feet
CY - cubic yard

Table C-3
Lower Ley Creek
Soil Remedial Alternative Cost Estimates (Off-site Disposal)

Description			Alternative Soil-1 No Action		Alternative Soil-2 Excavation of Soil to Meet Cleanup Goals		Alternative Soil-3 Excavation of Southern Swale Soils to Meet Cleanup Goals and Soil Cap for Northwest Soils		Alternative Soil-4 Soil Cap Over All Contaminated Soils	
Cost Item	**Units**	**Unit Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**
Construction Activities										
General Site Mobilization	**LS**	**$ 40,000**	0	$ -	1	$ 40,000	1	$ 40,000	1	$ 40,000
Excavate Soils	**CY**	**$ 15**	0	$ -	75,239	$ 1,128,585	73,997	$ 1,109,955	63,865	$ 957,975
Transport and Dispose of Material Onsite (Non-TSCA)	**ton**	**$ 5**	0	$ -	0	$ -	0	$ -	0	$ -
Transport and Dispose of Material Offsite (0-50 ppm)	**ton**	**$ 75**	0	$ -	81,258	$ 6,094,359	79,917	$ 5,993,757	68,974	$ 5,173,065
Transport and Dispose of Material Offsite (50-500 ppm)	**ton**	**$ 225**	0	$ -	3,611	$ 812,581	3,552	$ 799,168	3,066	$ 689,742
Transport and Dispose of Material Offsite (500 ppm +)	**ton**	**$ 369**	0	$ -	903	$ 333,158	888	$ 327,659	766	$ 282,794
Cultural Study	**hour**	**$ 100.00**	0	$ -	500	$ 50,000	500	$ 50,000	500	$ 50,000
Wetland/Habitat Restoration	**SF**	**$ 0.35**	0	$ -	892,071	$ 312,225	892,071	$ 312,225	892,071	$ 312,225
1-Foot Soil Capping	**SF**	**$ 1.00**	0	$ -	66,034	$ 66,034	72,736	$ 72,736	134,576	$ 134,576
Backfill Soil/Habitat Layer	**CY**	**$ 30.00**	0	$ -	75,239	$ 2,257,170	73,749	$ 2,212,470	61,326	$ 1,839,780
Sub-Total Construction Costs				$ -		**$ 11,094,112**		**$ 10,917,969**		**$ 9,480,157**
Contingency	**15%**			$ -		$ 1,664,117		$ 1,637,695		$ 1,422,024
Total Construction Cost				**$ -**		**$ 12,758,229**		**$ 12,555,665**		**$ 10,902,181**
Professional and Technical Services										
Engineering	**10%**			$ -		$ 1,275,823		$ 1,255,566		$ 1,090,218
Construction Management	**20%**			$ -		$ 2,551,646		$ 2,511,133		$ 2,180,436
Project Management	**10%**			$ -		$ 1,658,570		$ 1,632,236		$ 1,417,283
Sub-Total Professional and Technical Services				$ -		**$ 5,486,039**		**$ 5,398,936**		**$ 4,687,938**
Annual Operation and Maintenance										
Soil Cap Maintenance and Habitat Restoration Monitoring	**yr**	**$ 5,000**	0	$ -	1	$ 5,000	1	$ 5,000	1	$ 5,000
General Reporting & Management	**yr**	**$ 10,000**	0	$ -	1	$ 10,000	1	$ 10,000	1	$ 10,000
Sub-Total Annual Operation and Maintenance				$ -		**$ 15,000**		**$ 15,000**		**$ 15,000**
Periodic Costs										
5 year Review	**5 yr**	**$ 20,000**	1	$ 20,000	0	$ -	1	$ 20,000	1	$ 20,000
Sub-Total Periodic Costs				**$ 20,000**		**$ -**		**$ 20,000**		**$ 20,000**
Total Capital Costs (Construction, Professional and Technical Services)				$ -		$ 18,244,268		$ 17,954,600		$ 15,590,118
Total Annual Cost (O&M and Periodic Costs)				$ 4,000		$ 15,000		$ 19,000		$ 19,000
Estimated O & M Duration	**yr**			30		30		30		30
Discount Rate	**7%**									
Present Value (of Annual Costs)				$49,636		$186,136		$235,772		$235,772
Total Project Net Present Value				**$49,636**		**$18,430,403**		**$18,190,372**		**$15,825,890**

Notes:
LS- Lump Sum
ft - feet
CY - cubic yard

Table C-4
Lower Ley Creek
Sediment Remedial Alternative Cost Estimates (Off-site Disposal)

Description			Alternative Sediment-1 No Action		Alternative Sediment-2 Removal of Sediment to Cleanup Goals		Alternative Sediment-3 Granular Material Sediment Cap		Alternative Sediment-4 Engineered Bentonite Sediment Cap		Alternative Sediment-5 Monitored Natural Recovery	
Cost Item	**Units**	**Unit Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**
Construction Activities												
General Site Mobilization	**LS**	**$ 40,000**	0	$ -	1	$ 40,000	1	$ 40,000	1	$ 40,000	0	$ -
Sediment Conditioning Area Construction	**LS**	**$ 60,000**	0	$ -	1	$ 60,000	1	$ 60,000	1	$ 60,000	0	$ -
Excavation Equipment Mobilization	**LS**	**$ 40,000**	0	$ -	1	$ 40,000	1	$ 40,000	1	$ 40,000	0	$ -
Shallow Excavation from Shore	**CY**	**$ 15**	0	$ -	72,724	$ 1,090,860	56,649	$ 849,735	39,578	$ 593,670	0	$ -
Backfill Sediments/Habitat Layer	**CY**	**$ 30**	0	$ -	19,192	$ 575,760	36,450	$ 1,093,500	35,467	$ 1,064,010	0	$ -
Dewater/ Condition Sediments	**CY**	**$ 5**	0	$ -	72,724	$ 363,620	56,649	$ 283,245	39,578	$ 197,890	0	$ -
Transport and Dispose of Material Onsite	**ton**	**$ 5**		$ -	0	$ -	0	$ -	0	$ -	0	$ -
Transport and Dispose of Material Offsite (0-50 ppm)	**ton**	**$ 75**	0	$ -	82,905	$ 6,217,902	64,580	$ 4,843,490	45,119	$ 3,383,919	0	$ -
Transport and Dispose of Material Offsite (50-500 ppm)	**ton**	**$ 225**	0	$ -	3,491	$ 785,419	2,719	$ 611,809	1,900	$ 427,442	0	$ -
Transport and Dispose of Material Offsite (500 ppm +)	**ton**	**$ 369**	0		873	$ 322,022	680	$ 250,842	475	$ 175,251	0	$ -
Water Treatment Costs	**gal**	**$ 1**	0	$ -	363,620	$ 363,620	283,245	$ 283,245	197,890	$ 197,890	0	$ -
Granular Material Cap	**CY**	**$ 30.00**	0	$ -	0	$ -	12,463	$ 373,890	0	$ -	0	$ -
3-in Bentonite Cap (freshwater formulation) and 3-in sand layer	**SF**	**$ 3.89**	0	$ -	0	$ -	0	$ -	443,956	$ 1,726,989	0	$ -
Armor Stone, Large Riprap Rock Cover	**CY**	**$ 53.79**	0	$ -	0	$ -	8,851	$ 476,095	0	$ -	0	$ -
Armor Stone, Medium Riprap Rock Cover	**CY**	**$ 53.11**	0	$ -	0	$ -	903	$ 47,958	0	$ -	0	$ -
Sub-Total Construction Costs				$ -		**$ 9,859,203**		**$ 9,253,809**		**$ 7,907,062**		**$ -**
Contingency	**15%**			$ -		$ 1,478,880		$ 1,388,071		$ 1,186,059		$ -
Total Construction Cost				$ -		**$ 11,338,084**		**$ 10,641,880**		**$ 9,093,121**		**$ -**
Professional and Technical Services												
Engineering	**10%**			$ -		$ 1,133,808		$ 1,064,188		$ 909,312		$ -
Construction Management	**20%**			$ -		$ 2,267,617		$ 2,128,376		$ 1,818,624		$ -
Project Management	**10%**			$ -		$ 1,473,951		$ 1,383,444		$ 1,182,106		$ -
Sub-Total Professional and Technical Services				$ -		**$ 4,875,376**		**$ 4,576,009**		**$ 3,910,042**		**$ -**

Table C-4 Continued
Lower Ley Creek
Sediment Remedial Alternative Cost Estimates (Off-site Disposal)

Description			Alternative Sediment-1 No Action		Alternative Sediment-2 Removal of Sediment to Cleanup Goals		Alternative Sediment-3 Granular Material Sediment Cap		Alternative Sediment-4 Engineered Bentonite Sediment Cap		Alternative Sediment-5 Monitored Natural Recovery	
Cost Item	**Units**	**Unit Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**
Annual Operation and Maintenance												
MNR Sampling	**yr**	**$ 100,000**		$ -	0	$ -	1	$ 100,000	1	$ 100,000	1	$ 100,000
MNR Reporting	**yr**	**$ 30,000**			0	$ -	1	$ 30,000	1	$ 30,000	1	$ 30,000
Sediment Cap Maintenance	**yr**	**$ 30,000**			0	$ -	1	$ 30,000	1	$ 30,000	0	$ -
General Reporting & Management	**yr**	**$ 10,000**		$ -	1	$ 10,000	1	$ 10,000	1	$ 10,000	1	$ 10,000
Sub-Total Annual Operation and Maintenance				$ -		**$ 10,000**		**$ 170,000**		**$ 170,000**		**$ 140,000**
Periodic Costs												
5 year Review	**5 yr**	**$ 20,000**	1	$ 20,000	0	$ -	1	$ 20,000	1	$ 20,000	1	$ 20,000
5 year Fish Sampling	**5 yr**	**$ 75,000**	0	$ -	1	$ 75,000	1	$ 75,000	1	$ 75,000	1	$ 75,000
Sub-Total Periodic Costs				**$ 20,000**		**$ 75,000**		**$ 95,000**		**$ 95,000**		**$ 95,000**
Total Capital Costs (Construction, Professional and Technical Services)				$ -		$ 16,213,459		$ 15,217,889		$ 13,003,163		$ -
Total Annual Cost (O&M and Periodic Costs)				$ 4,000		$ 25,000		$ 189,000		$ 189,000		$ 159,000
Estimated O & M Duration	**yr**			30		30		30		30		30
Discount Rate	**7%**											
Present Value (of Annual Costs)				$49,636		$310,226		$2,345,309		$2,345,309		$1,973,038
Total Project Net Present Value				**$49,636**		**$16,523,685**		**$17,563,198**		**$15,348,472**		**$1,973,038**

Notes:
LS- Lump Sum
ft - feet
CY - cubic yard

APPENDIX D

Site Photographs

Photograph 1 – Capping of former Town of Salina Landfill (looking west from Route 11)

Photograph 2 – Lower Ley Creek at about 1500 feet downstream of Route 11 (looking west)

Photograph 3 – View of Lower Ley Creek looking south from 7th North St.

Photograph 4 – View of Lower Ley Creek looking north from Park Street (I-81 crossing above)

APPENDIX E

Sand and Armor Sediment Capping Details

APPENDIX E

SAND AND ARMOR SEDIMENT CAPPING DETAILS

LOWER LEY CREEK SUBSITE OF THE ONONDAGA LAKE SUPERFUND SITE, SYRACUSE, NY

1.0 SUMMARY OF CAP DESIGN

The composition and dimensions of the components of a sediment cap can be referred to as the cap design. This design must physically isolate the contaminated sediment from the benthic environment and achieve the intended cap functions. The design must also include a habitat/bioturbation layer to provide a clean substrate for recolonization by bottom-dwelling organisms.

This appendix presents the basis of design for the granular material sediment cap (Alternative Sediment-3). In areas of the Site with low erosion potential (i.e., Old Ley Creek), the granular material sediment cap includes the following design layer:

- Isolation/Habitat Layer (2 feet [ft] thick).

In areas of the site with high erosion potential (i.e., Lower Ley Creek), the granular material cap includes the following design layers, from top to bottom:

- Habitat Layer (2 ft thick);
- Armor Layer (0.375 - 2.04 ft thick); and
- Isolation Layer (2 ft thick).

The following sections discuss the sediment transport characterization of each section of Lower Ley Creek and the design of each of these granular material caps.

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2.0 SEDIMENT TRANSPORT CHARACTERIZATION OF LOWER LEY CREEK

As stated in Section 4 of the Final Feasibility Study (FS) that incorporates this appendix, most of the Lower Ley Creek channel is considered to be neither erosional nor depositional on the basis of field evidence (i.e., suspended sediment flux from the bed is likely to be balanced evenly between erosion and deposition, and material entering the section of the creek as suspended load can be transported through the section). However, for sediment cap design, a more conservative evaluation of erosional potential is required. This is due to the potential of extreme hydrodynamic conditions (i.e., floods, ice scouring) causing permanent damage to the sediment cap and creating contaminate releases.

2.1 Streamflow Characteristics

One U.S. Geological Survey (USGS) stream gauge (USGS 04240120) is operated in the Lower Ley Creek Subsite. Monthly mean streamflows for Lower Ley Creek from 2000-2010 are exhibited in Figure 4.1 and peak flow events from 1974-2010 in Lower Ley Creek are shown in Figure 4.2 of this document.

Based on available information, the following general comments about Lower Ley Creek streamflow can be made:

- Runoff is typically low during the summer and early fall months, except during occasional frontal storms, and during midwinter when ice-cover forms or a snowpack is present in the watershed.
- Flood flows are most common during spring snowmelt, primarily early-March to mid-April.
- Based on monthly mean streamflows between 2000-2010, the average streamflow can be estimated at about 45 cubic feet per second (cfs).
- The maximum peak streamflow exhibited at Lower Ley Creek between 1974-2010 was approximately 1400 cfs.
- The U.S. Army Corps of Engineers (USACE) prepared a 100-year storm hydrograph in June 1971 which estimated peak flow in Lower Ley Creek to be 2000 cfs.

2.2 Determination of the Erosional Potential of Lower Ley Creek

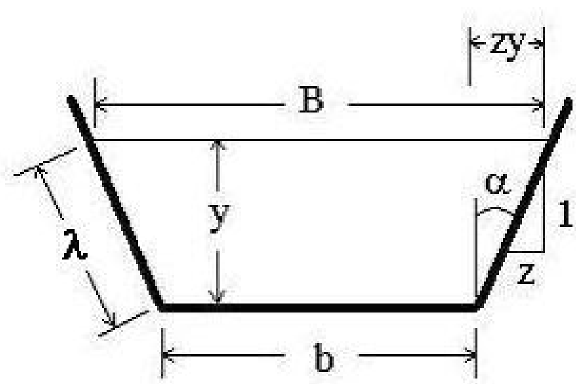
The LATA Team calculated the erosional potential of Lower Ley Creek using three different procedures:

- The standard Hjulstrom Curve (Figure E-2) that is widely cited and used in literature and applications (Fryirs and Brierley, 2012).
- The alternative Hjulstrom Curve (Marshak, 2007) that directly relates river bed materials to river bed status under different river velocities (Figure E-3).
- Guidance provided in Chapter 3 of the EM 1110-2-1601 entitled *Hydraulic Design of Flood Control Channels* (USACE, 1994).

2.2.1 Hjulstrom Curves

Because this is a natural main stream with significant vegetation and relatively slow water movement, we assume Manning's coefficient (n) to be 0.05 (Chow, 1959). The energy slope (S) was estimated to be 0.0003 (ft/ft) using Google Maps, however, this value may subject to significant variation. Therefore, we altered it from original estimate of 0.0003 to 0.0001 (ft/ft). The cross-section is assumed to be rectangular, or trapezoidal with zero side slope (z) (Figure E-1). Because the river width (B) is much larger than its depth (Y), this assumption is acceptable.

Figure E-1
Trapezoidal Cross-Section



The average depth of water may subject to the most variation and we assume it is unknown. We adjust the depth to obtain desired flow rate (Q) of 45 cfs. The final adjusted depths are 1.6, 1.3, and 2 ft deep for the upstream, middle and downstream sections, respectively (Table E-1). They appear to be within the reasonable range. Under this flow rate of 45 cfs, velocity is calculated by dividing the flow rate by the cross-section area (A). The final velocities are **12, 11, and 14 cm/s** for the upstream, middle and downstream sections, respectively (we change to SI unit to use the Hjulstrom curve, see Figure E-2 and Figure E-3).

Using the set of parameters estimated from the observation data, we assume the same energy slope and river width, then adjust the depth to obtain the desired maximum flow rate of 2000 cfs (100-year flood). Using the final set of depths of 18.4, 13.8, and 25 ft for the upstream, middle and downstream sections, respectively (Table E-2), we calculated the velocities to be **47, 44 and 49 cm/s** for the upstream, middle and downstream sections, respectively**.**

Based on these maximum velocities, we reviewed Hjulstrom Curve and determined the corresponding status of river bed materials. Note that two versions of Hjulstrom Curves are used. One is the standard Hjulstrom Curve (Figure E-2) that is widely cited and used in literature and applications (Fryirs and Brierley, 2012). This curve relates river bed material to the material particle status under different river velocities. The second version is an alternative Hjulstrom Curve (Marshak, 2007) that directly relates river bed materials to river bed status under different river velocities (Figure E-3).

Using the Hjulstrom Curve in the most common form (Figure E-2), we conclude that at flow rate of 45 cfs, all sections of the creek are in transition mode (i.e., the bed material is under both erosion and deposition). At flow rate of 2000 cfs, the upstream section of Lower Ley Creek will be in erosion mode, while the middle and downstream sections will be in transition mode.

Using the Alternative Hjulstrom Curve (Figure E-3), we conclude that at flow rate of 45 cfs, all sections of Lower Ley Creek are in sedimentation mode. At flow rate of 2000 cfs, the middle and downstream sections of Lower Ley Creek will be in transition mode, but upstream section is in danger of erosion.

Although these two curves are slightly different, they both indicate the potential for erosion and transport of particles during 100-year flood conditions in the upstream section of Lower Ley Creek.

Figure E-2
Standard Hjulstrom Curve

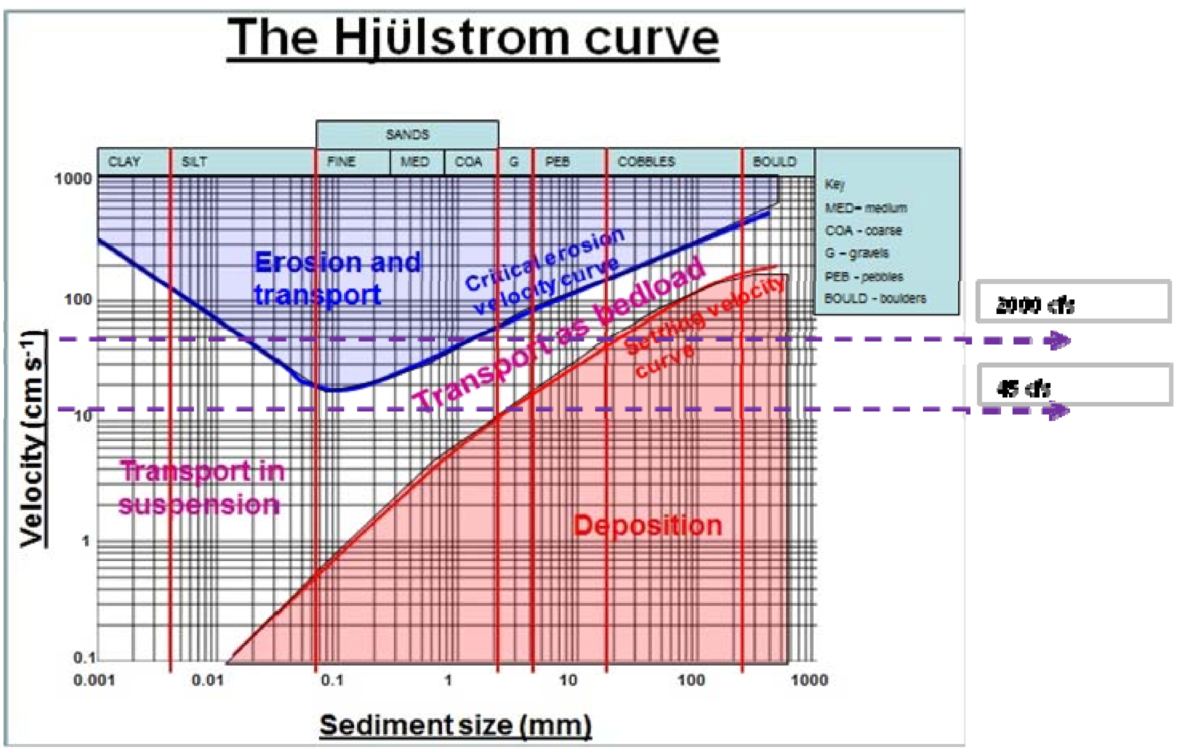
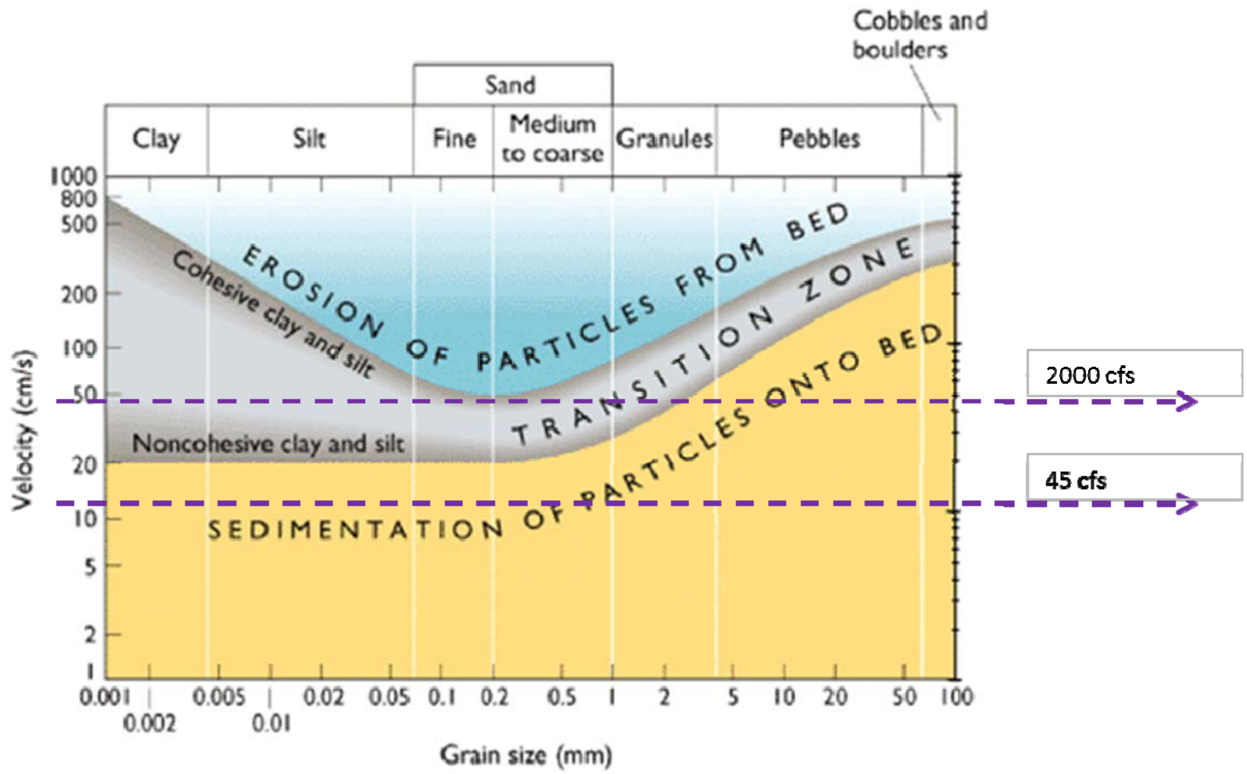


Figure E-3
Alternative Hjulstrom Curve



2.2.2 Modified USACE Equation

Because Lower Ley Creek does not experience significant navigation, it mainly requires protection for the maximum flood flows, storm velocities, and ice scouring. At sites without navigation having flow velocities typically found in flood control channels, the maximum grain size required to resist erosion should follow the guidance provided in Chapter 3 of the EM 1110-2-1601 entitled *Hydraulic Design of Flood Control Channels* (USACE, 1994).

Velocity and flow depth are the two basic factors used to determine grain size requirements. The following equation, modified from EM 1110-2-1601, relates velocity to grain size and is applicable to any location in the channel:

$$D_{50} = S_f*C_s*C_v*C_t*C_g*_d*[\{(\tilde{a}_w/(\tilde{a}_s-\tilde{a}_w)\}^{1/2}*\{V/(\sqrt{(K_1*g*d)})\}]^{2.5}$$

<u>Where:</u>

D_{50} = characteristic grain size of which 50 percent (%) is finer by weight

S_f = safety factor (minimum 1.1)

C_s = stability coefficient for incipient failure (0.30 for angular rock, 0.375 for rounded rock)

C_v = Velocity distribution coefficient (1.0 for straight channels and inside of bends, 1.25 downstream of concrete channels and end of dykes)

C_t = blanket thickness coefficient (typically 1.0 for flood flows)

C_g = gradation uniformity coefficient (typical range = 1.8 to 3.5)

d = local water depth

$\tilde{a}_w$ = unit weight of water

$\tilde{a}_s$ = unit weight of stone (typical value of 165 pounds [lb]/ft^3)

V = local depth average water velocity

K_1 = side slope correction factor (0.88 for 2H:1V)

g = gravitational constant

Grain size calculations for Lower Ley Creek are shown in Table E-3.

2.2.3 Upstream Section of Lower Ley Creek

The upstream section of Lower Ley Creek extends from just upstream of the Route 11 Bridge to the intersection with the 7th North Street Bridge. Substrate in this section ranges from sand to clay with some small (1-4 centimeter) stones. Old Ley Creek enters Lower Ley Creek near the middle of the section and Beartrap Creek enters Lower Ley Creek at the downstream end of the section. There are multiple bends and bridge crossings in this section of Lower Ley Creek.

Water depth is variable, but is typically between 2 to 4 ft deep. The average width of the upstream Section of Lower Ley Creek is about 70 ft. Based on an average streamflow of 45 cfs; a peak streamflow of 2000 cfs; an average water depth of 3 ft; and an average width of 70 ft; the approximate water velocities for this section of Lower Ley Creek are calculated as:

- Average = 0.21 ft/s; and
- Maximum = 9.5 ft/s.

As shown in Table E-3, a maximum water velocity of 9.5 ft/s in 3 ft deep water require a median grain size that exceeds those typically found in a granular sand cap (0.0002 ft diameter for fine sand). Therefore, based on the maximum water velocity and average depth of the creek, an armor layer should be included in any sediment cap design in the upstream section of Lower Ley Creek.

2.2.4 Middle Section of Lower Ley Creek

As stated in Section 4, the middle section of Lower Ley Creek extends from the intersection with 7th North Street Bridge to approximately 2,000 ft southwest of the intersection (near the

Alliance Bank Stadium). This section consists of a generally straight, uniform, low gradient stream. Substrate in this section mostly consists of silt and clays. There is only one bridge crossing in this section of Lower Creek.

Water depth in this section is approximately 4 ft deep. The average width of the middle section of Lower Ley Creek is about 100 ft. Based on an average streamflow of 45 cfs; a peak streamflow of 2000 cfs; an average water depth of 4 ft; and an average width of 100 ft; the approximate water velocities for this section of Lower Ley Creek are calculated as:

- Average = 0.11 ft/s; and
- Maximum = 5 ft/s.

As shown in Table E-3, a maximum water velocity of 5 ft/s in 4 ft deep water requires a median grain size that exceeds those typically found in a granular sand cap (0.0002 ft diameter for fine sand). Therefore, based on the maximum water velocity and average depth of the creek, an armor layer should be included in any sediment cap design in the middle section of Lower Ley Creek.

2.2.5 Downstream Section of Lower Ley Creek

As stated in Section 4, the downstream section of Lower Ley Creek extends from approximately 2,000 ft southwest of the 7th North Street Bridge intersection to the intersection with Onondaga Lake. This section has a low gradient and substrate in this section mostly consists of silt and clay. There are multiple bends and bridge crossings in this section of Lower Ley Creek.

Water depth is variable, but is typically between 8 to 12 ft deep. The average width of the downstream section of Lower Ley Creek is about 50 ft. Based on an average streamflow of 45 cfs; a peak streamflow of 2000 cfs; an average water depth of 10 ft; and an average width of 50 ft; the approximate water velocities for this section of Lower Ley Creek are calculated as:

- Average = 0.09 ft/s; and
- Maximum = 4 ft/s.

As shown in Table E-3, a maximum water velocity of 4 ft/s in 10 ft deep water requires a median grain size that exceeds those typically found in a granular sand cap (0.0002 ft diameter for fine sand). Therefore based on the maximum water velocity and average depth of the creek, an armor layer should be included in any sediment cap design in the downstream section of Lower Ley Creek. However, the downstream section of Lower Ley Creek will not be capped under the granular material sediment cap alternative (Alternative Sediment-3).

2.3 Conclusion

While the Hjustrom Curves only indicate that the upstream section of Lower Ley Creek may require an armor layer, the modified USACE equation indicates that the middle section of Lower Ley Creek may also require an armor layer. Although these equations account for a 100-year flood event, they do not account for ice scouring events, which may temporarily erode portions of the granular sediment cap in all sections of Lower Ley Creek. Therefore, based on the potential of ice scouring events, an armor layer will be included in the granular sediment cap design for the upstream and middle sections of Lower Ley Creek.

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3.0 GRANULAR SEDIMENT CAP DESIGN FOR LOW EROSIONAL AREAS

As discussed above, the sediments in Old Ley Creek exhibit low erosional potential so an armor layer is not required for the granular sediment cap in this location.

Therefore, the preliminary cap design for the granular sediment cap in this was determined through an evaluation of site-specific information so that the cap would meet the following objectives:

- Physical isolation of COPCs in the sediment from the benthic environment;
- Chemical isolation (i.e., reduce the flux of dissolved COPCs to the water column);
- Erosion protection (i.e., to mitigate resuspension and transport of sediments to downstream areas) to maintain cap stability against forces resulting from open water river flows and ice jam-related flows; and
- Provide a clean substrate for recolonization by bottom-dwelling organisms.

In accordance with EPA (Palermo et al., 1998) and USACE (USACE, 1998) design guidance, the total thickness of a protective cap was specified as the sum of the thicknesses required to achieve each of the design objectives listed above. An additional factor of safety beyond the EPA and USACE design requirements was also incorporated into the preliminary cap design to ensure its protectiveness.

Therefore, a 2-ft thick granular sand cap was designed for Old Ley Creek. This is conservative design in a simple hydrologic system exhibiting low hydraulic gradients and weak erosional and depositional environments. In addition, a 2-ft thick granular sand cap will physically and chemically isolate the COPCs in the sediment below and provide a clean substrate for recolonization by bottom-dwelling organisms.

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4.0 GRANULAR SEDIMENT CAP DESIGN FOR HIGH EROSIONAL AREAS

As discussed above, all sections of Lower Ley Creek exhibit a potentially high erosional potential, so an armor layer is required for the granular sediment cap for upstream and middle sections of Lower Ley Creek.

The preliminary cap design for the armored sediment cap was determined through an evaluation of site-specific information so that the cap would meet the following objectives:

- Physical isolation of COPCs in the sediment from the benthic environment;
- Chemical isolation (i.e., reduce the flux of dissolved COPCs to the water column);
- Erosion protection (i.e., to mitigate resuspension and transport of sediments to downstream areas) to maintain cap stability against forces resulting from open water river flows and ice jam-related flows; and
- Provide a clean substrate for recolonization by bottom-dwelling organisms.

In accordance with EPA (Palermo et al., 1998) and USACE (USACE, 1998) design guidance, the total thickness of a protective cap was specified as the sum of the thicknesses required to achieve each of the design objectives listed above. An additional factor of safety beyond the EPA and USACE design requirements was also incorporated into the preliminary cap designs to ensure their protectiveness.

4.1 Design of Isolation Layer

The objective of this study was to evaluate the thickness of the chemical isolation layer so that the chemical isolation layer is able to contain the chemicals in the river sediments.

The point of compliance was assumed to be at the bottom of the habitat layer, which corresponds with the top of the chemical isolation layer. The source concentration in the sediments is assumed to be the pore water concentration that is in equilibrium with the soil concentration. The relationship between the soil concentration and pore water concentration can be described by a sorption linear isotherm (See Equation 1.0). The soil organic carbon-water partitioning coefficient of polychlorinated biphenyls (PCBs) is assumed to be 1,380,384 liters per kilogram (L/kg). The organic fraction of the river sediment was measured at 3.7 %.

The transport process within the chemical isolation layer is described by a one dimensional advection-diffusion model with Retardation effects (Equation 2.0). Because the point of compliance was assumed to be at the bottom of the habitat layer, the traveling distance equals to the thickness of the chemical isolation layer. The traveling time is assumed to be 1000 years, which is equivalent to a very long time period.

The other assumption of model input parameters include:

- the porosity of the capping material is assumed to be 0.4;
- the bulk density of the chemical isolation layer is assumed to be 1.59 grams per cubic centimeter (g/cm^3);
- the dispersivity of the chemical isolation layer is assumed to be 0.0125 cm; and
- the molecular diffusion coefficient of PCB at 45 degrees Fahrenheit is assumed to be 3.42E-06 square centimeters per second (cm^2/sec).

The flow velocity within the chemical isolation layer is assumed to be the base flow upwelling velocity through the river sediments (Equation 3.0). It was reported that the base flow is approximately 56% at an average flow rate of 45 cfs, which resulted in a 25 cfs baseflow. This value is close to the minimum flow observed from the USGS stream gauge (USGS 04240120) at the Site.

The model parameters and final results are listed in Table E-4. At the maximum levels of PCBs detected below a depth of 2 ft in the upstream section of Lower Ley Creek (69 milligrams per kilogram [mg/kg]), a 60 cm (~2 ft) thick isolation layer is required to meet the 0.09 parts per billion (ppb) PCB water quality standard for use as a human water source. All sediment between 0-2 ft will be excavated before a sediment cap is put in place. Therefore, a 2-ft thick granular sand cap was designed as the isolation layer for high erosional potential areas in the upstream section of Lower Ley Creek. A 2-ft thick granular sand cap will physically and chemically isolate the COPCs in the sediment below and provide a supportive base for the overlying armor layer.

At the maximum levels of PCBs detected below a depth of 2 ft in the middle section of Lower Ley Creek (5.5 mg/kg), a 45 cm (~1.5 ft) thick isolation layer is required to meet the 0.09 ppb PCB water quality standard for use as a human water source. All sediment between 0-2 ft will be excavated before a sediment cap is put in place. Therefore, a 1.5-ft thick granular sand cap was designed as the isolation layer for high erosional potential areas in the middle section of Lower Ley Creek. A 1.5-ft thick granular sand cap will physically and chemically isolate the COPCs in the sediment below and provide a supportive base for the overlying armor layer.

The downstream section of Lower Ley Creek will not be capped under the granular material sediment cap alternative (Alternative Sediment-3).

The equations used in the calculations are listed below.

4.1.1 Equations

1. **<u>Initial Pore Water Concentration</u>**

The initial pore water concentration (C_0) is a function of the concentration in the underlying sediment. The sorption process is described by a linear isotherm (Fetter, 1993):

$$C_0 = \frac{C_s}{K_d} \quad \text{(Equation 1.0)}$$

Where:

C_s is the concentration in the sediments (mg/kg);

K_d is the distribution coefficient (L/kg).

The distribution coefficient K_d of organic compound is primarily a function of the organic carbon fraction of the soil matrix, for river sediments, it is the sediment organic carbon fraction. For chemical isolation layer, it is the organic carbon fraction of the isolation layer.

$$K_d = f_{oc}K_{oc} \quad \text{(Equation 1.1)}$$

Where:

f_{oc} is the organic carbon fraction (%);

K_{oc} is the soil organic carbon-water partition coefficient (L/kg).

2. <u>One dimensional Advection-Diffusion Model (Fetter, 1993) with Retardation Effect</u>

A one dimensional advection-diffusion model was used to model the transport within the chemical isolation layer. The model considers a transient transport of a fixed-step concentration boundary within a single media, semi-infinite layer. The boundary and initial conditions are given by:

Initial condition: $C(x,0) = 0,\ x \geq 0$

Boundary conditions: $C(0,t) = C_0,\ t \geq 0$ and $C(\infty,t) = 0,\ t \geq 0$

<u>The solution is (Ogata and Banks, 1961):</u>

$$C(L,t) = C_0\left[erfc\left(\frac{L - v_x t/R_f}{2\sqrt{D_L t/R_f}}\right) + \exp\left(\frac{v_x L}{D_L}\right) erfc\left(\frac{L + v_x t/R_f}{2\sqrt{D_L t/R_f}}\right)\right],\ x \geq 0 \qquad \text{(Equation 2.0)}$$

Where:

$C(L,t)$ is the concentration at location L, and time t;

L is the traveling distance (L);

t is the traveling time (T);

C_0 is the constant concentration at the boundary (M/L^3);

v_x is the linear velocity (L/T);

D_L is the longitudinal dispersion coefficient (L^2/T); and

R_f is the retardation factor (dimensionless).

The longitudinal dispersion coefficient D_L is a function of longitudinal dispersivity (α_L) and linear velocity (v_x), and is calculated by:

$$D_L = \alpha_L \cdot v_x + D^* \quad \text{(Equation 2.1)}$$

Where:

α_L is the longitudinal dispersivity (L);

D^* is the molecular diffusion coefficient (L^2/T).

The retardation efficient is applied in the form of a retardation factor (R_f), given by:

$$R_f = 1 + \frac{B_d K_d}{\theta} \quad \text{(Equation 2.2)}$$

Where:

B_d is the bulk density of the chemical isolation layer (M/L^3);

$\theta$is the porosity of the river sedimentation layer (Dimensionless).

3. <u>Upwelling Velocity</u>

The linear velocity v_x is function of the river upwelling Darcy velocity (q_x) and is calculated by:

$$v_x = \frac{q_x}{\theta} = \frac{Q_{base}}{A} \quad \text{(Equation 3.0)}$$

Where:

q_x is the upwelling Darcy velocity (L/T);

Q_{base} is the average river base flow (L^3/T);

A is the total river bottom area that contributes to the base flow (L^2).

4.2 Design of Armor Layer

An armor layer will be incorporated into the granular sediment cap design in areas of high erosional potential. The thickness of the armor will replace any sediment cap thickness component for erosion. Both the size and thickness of the armor stones play a significant role in defining the stability of the armor layer.

4.2.1 Armor Stone Sizing for Flood Flows

Because Lower Ley Creek does not experience significant navigation, it mainly requires protection for the maximum flood flows, storm velocities, and ice scouring. At sites without navigation having flow velocities typically found in flood control channels, the armor protection requirements should follow the guidance provided in Chapter 3 of the EM 1110-2-1601 entitled *Hydraulic Design of Flood Control Channels* (USACE, 1994).

Velocity and flow depth are the two basic factors used in armor protection. The following equation, modified from EM 1110-2-1601, relates velocity to stone size and is applicable to any location in the channel:

$$D_{50} = S_f*C_s*C_v*C_t*C_g*_d*[\{(\tilde{a}_w/(\tilde{a}_s-\tilde{a}_w)\}^{1/2}*\{V/(\sqrt{}(K_1*g*d))\}]^{2.5}$$

<u>Where:</u>

D_{50} = characteristic riprap size of which 50 % is finer by weight

S_f = safety factor (minimum 1.1)

C_s = stability coefficient for incipient failure (0.30 for angular rock, 0.375 for rounded rock)

C_v = Velocity distribution coefficient (1.0 for straight channels and inside of bends, 1.25 downstream of concrete channels and end of dykes)

C_t = blanket thickness coefficient (typically 1.0 for flood flows)

C_g = gradation uniformity coefficient (typical range = 1.8 to 3.5)

d = local water depth

$\tilde{a}_w$ = unit weight of water

$\tilde{a}_s$ = unit weight of stone (typical value of 165 lb/ft^3)

V = local depth average water velocity

K_1 = side slope correction factor (0.88 for 2H:1V)

g = gravitational constant

Armor stone size calculations for Lower Ley Creek are shown in Table E-5. Due to the variation in water velocities and water depth across the creek, the medium grain size required to withstand erosion varies per section of Lower Ley Creek.

The upstream section of Lower Ley Creek requires a median stone size of approximately 1.36 ft in diameter. The middle section of Lower Ley Creek requires a median stone size of approximately 0.25 ft in diameter. Finally, the downstream section of Lower Ley Creek requires a median stone size of approximately 0.12 ft in diameter. However, the downstream section of Lower Ley Creek will not be capped under the granular material sediment cap alternative (Alternative Sediment-3).

4.2.2 Armor Stone Thickness for Flood Flows

Minimum layering thickness requirements for an armor stone layer vary depending on the type of attack on the revetment. For flood flows, the minimum layer thickness is $1.5*D_{50}$ (max). Using this calculation, the thickness of the armor layer in the upstream section of Lower Ley Creek should be 1.5*1.36 ft = 2.04 ft thick. The thickness of the armor layer in the middle section of Lower Ley Creek should be 1.5*0.25 ft = 0.375 ft thick.

4.2.3 Armor Stone Habitat Layer

In order to provide a clean substrate for recolonization by bottom-dwelling organisms, a 2-ft habitat/bioturbation layer will be placed above the armor stone layer in the Upstream and Middle Sections of Lower Ley Creek. The habitat layer will be composed of fine sand, although natural processes will eventually change the uppermost layer of the cap. It is likely that portions of this habitat layer may fill the interstices of the armor stones. This is permitted according to the EPA *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (EPA, 2007).

5.0 REFERENCES

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TABLES

Table E-1

Using Manning's Equation to Estimate the most Plausible Set of River Parameters based on Observed Data

Observation					Assume Rectangle or Trapezoidal						Use Manning's Equation, adjust depth to fit Q						
	Material	Manning's n	**Q_ave_cfs**	Energy Slope S	B_width _Top_ft	**Depth_Y_ft**	Side Slope Z	Cross-section Area A_ft^2	P_wetted_ Perimeter _ft	Hydraulic Radius_(R=A/P)_ft	1.486/ n	R^(2/3)	S^(1/2)	A*R^2/3 *S^1/2	**Q_try_cfs**	Velocity_ ft/s	**Velocity_c m/s**
Upstream	Sand	0.05	**45**	0.0001	70	**1.62**	0	113.4	73.24	1.55	29.72	1.34	0.01	1.52	**45**	0.40	**12**
Mid-stream	Silt and Clay	0.05	**45**	0.0001	100	**1.30**	0	130	102.6	1.27	29.72	1.17	0.01	1.52	**45**	0.35	**11**
Downstream	Silt and Clay	0.05	**45**	0.0001	50	**2.00**	0	100	54	1.85	29.72	1.51	0.01	1.51	**45**	0.45	**14**

Table E-2

Estimate River Depth at Maximum Flow Rate (100-yr flood), and Corresponding Velocity

Maximum Flow Rate					Assume Rectangle or Trapezoidal						Use Manning's Equation, adjust depth to fit Q						
Location	Material	Manning's n	**Q_cft**	Energy Slope S	B_width_T op_ft	Depth_Y_ft	Side Slope Z	Cross-section Area A_ft^2	P_wetted _Perimeter_ft	Hydraulic Radius_(R=A/P)_ft	1.486/ n	R^(2/3)	S^(1/2)	A*R^2/3 *S^1/2	**Q_try_cfs**	Velocity_ ft/s	**Velocity_c m/s**
Upstream	Sand	0.05	**2000**	0.0001	70	**18.40**	0	1288	106.8	12.06	29.72	5.26	0.01	67.73	**2013**	1.55	**47**
Mid-stream	Silt and Clay	0.05	**2000**	0.0001	100	**13.80**	0	1380	127.6	10.82	29.72	4.89	0.01	67.49	**2006**	1.45	**44**
Downstream	Silt and Clay	0.05	**2000**	0.0001	50	**25.00**	0	1250	100	12.50	29.72	5.39	0.01	67.33	**2001**	1.60	**49**

Table E-3
Erosional Estimates Using Modified USACE Equation

S_f	C_s	C_v	C_t	C_g	K_1	d	V	$ã_s$	$ã_w$	g	D_{50}
Safety Factor	**Stability Coefficient**	**Velocity Distribution Coefficient**	**Blanket Thickness Coefficient**	**Gradation Coefficient**	**Side slope Correction Factor**	**Water Depth (ft)**	**Water Velocity (ft/s)**	**Unit Weight of Stone (lb/ft^3)**	**Unit Weight of Water (lb/ft^3)**	**Gravitational Constant (ft/s^2)**	**Median Grain Size Required to Withstand Erosion (ft diameter)**
Upstream Section of Lower Ley Creek											
1.1	0.375	1.25	1	1.518	0.88	3	9.5	165	62.4	3.22E+01	**1.36049**
Middle Section of Lower Ley Creek											
1.1	0.375	1.25	1	1.518	0.88	4	5	165	62.4	3.22E+01	**0.25444**
Downstream Section of Lower Ley Creek											
1.1	0.375	1.25	1	1.518	0.88	10	4	165	62.4	3.22E+01	**0.11583**

Notes:
ft - feet
s - seconds
lb - pounds

Table E-4
Isolation Layer Thickness Calculations

Calculation Sheet using One dimensional dispersion equation (Ogata and Banks, 1961)
C = C0/2 *[erfc(U) + exp(Pe)*erfc(V)]

	Cs	Toc	ρ_b	ε or (n)	v	U	C_o	a	Dw	D'	foc	Koc	K_d	z	R_f	t_{50}	λ	Transient Model Time	C in Porewater at top of isolation layer	C in sediment at top of isloation layer		Vx/Rf	D/Rf	U in erfc(U) = (L-Vx*t)/(2*(D*t)^0.5)	V in erfc(V) = (L+Vx*t)/(2*(D*t)^0.5)	Pe = Vx*L/DL	[erfc(U) + exp(Pe) * erfc(V)]/2
	CPOI (Concentration in Underlying Sediment)	Fraction of organic carbon in sediment material	Bulk density of cap material (1- ε)*ρs	Porosity	Porewater Velocity, i.e. Linear Velocity (U/ε)	Darcy Velocity (or v*ε)	Initial Porewater concentration	Dispersivity	Molecular diffusion coefficient (at 45 F)	Diffusion/ dispersion coefficient	Fraction of organic carbon in cap material	Organic carbon partition coeff for organics	Observed partition coefficient for CB (organics=foc* Koc, metals=literature value)	Chemical Isolation Layer Thickness	Retardation Factor	Half Life	Reaction Term (=ln2/t_{50})										
Chemical	mg/kg		g/cm^3		cm/yr	cm/yr	ug/L (ppb)	cm	cm^2/sec	cm^2/yr		L/kg	L/kg	cm		day	yr^{-1}	years	ppb	ug/kg							
	69	3.70%	1.59	0.4	250.0	100	1.350975428	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	30	5488	0	0.0	1000	1.34347	1854.51		0.0456	0.0202	-1.7294	8.4007	67.5809	0.9944
	69	3.70%	1.59	0.4	250.0	100	1.350975428	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	38.1	5488	0	0.0	1000	1.20856	1668.28		0.0456	0.0202	-0.8288	9.3013	85.8277	0.8946
	69	3.70%	1.59	0.4	250.0	100	1.350975428	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	45.72	5488	0	0.0	1000	0.69876	964.55		0.0456	0.0202	0.0185	10.1486	102.9933	0.5172
	69	3.70%	1.59	0.4	250.0	100	1.350975428	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	53.34	5488	0	0.0	1000	0.16547	228.42		0.0456	0.0202	0.8657	10.9958	120.1588	0.1225
PCB	69	3.70%	1.59	0.4	250.0	100	1.350975428	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	60	5488	0	0.0	1000	0.01806	24.93		0.0456	0.0202	1.6063	11.7363	135.1618	0.0134
	10	3.70%	1.59	0.4	250.0	100	0.19579354	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	30	5488	0	0.0	1000	0.19471	268.77		0.0456	0.0202	-1.7294	8.4007	67.5809	0.9944
	10	3.70%	1.59	0.4	250.0	100	0.19579354	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	38.1	5488	0	0.0	1000	0.17515	241.78		0.0456	0.0202	-0.8288	9.3013	85.8277	0.8946
	10	3.70%	1.59	0.4	250.0	100	0.19579354	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	45.72	5488	0	0.0	1000	0.10127	139.79		0.0456	0.0202	0.0185	10.1486	102.9933	0.5172
	10	3.70%	1.59	0.4	250.0	100	0.19579354	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	53.34	5488	0	0.0	1000	0.02398	33.10		0.0456	0.0202	0.8657	10.9958	120.1588	0.1225
PCB	10	3.70%	1.59	0.4	250.0	100	0.19579354	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	60	5488	0	0.0	1000	0.00262	3.61		0.0456	0.0202	1.6063	11.7363	135.1618	0.0134
	5.5	3.70%	1.59	0.4	250.0	100	0.107686447	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	30	5488	0	0.0	1000	0.10709	147.82		0.0456	0.0202	-1.7294	8.4007	67.5809	0.9944
	5.5	3.70%	1.59	0.4	250.0	100	0.107686447	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	38.1	5488	0	0.0	1000	0.09633	132.98		0.0456	0.0202	-0.8288	9.3013	85.8277	0.8946
	5.5	3.70%	1.59	0.4	250.0	100	0.107686447	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	45.72	5488	0	0.0	1000	0.05570	76.88		0.0456	0.0202	0.0185	10.1486	102.9933	0.5172
	5.5	3.70%	1.59	0.4	250.0	100	0.107686447	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	53.34	5488	0	0.0	1000	0.01319	18.21		0.0456	0.0202	0.8657	10.9958	120.1588	0.1225
PCB	5.5	3.70%	1.59	0.4	250.0	100	0.107686447	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	60	5488	0	0.0	1000	0.00144	1.99		0.0456	0.0202	1.6063	11.7363	135.1618	0.0134
	1	3.70%	1.59	0.4	250.0	100	0.019579354	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	30	5488	0	0.0	1000	0.01947	26.88		0.0456	0.0202	-1.7294	8.4007	67.5809	0.9944
	1	3.70%	1.59	0.4	250.0	100	0.019579354	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	38.1	5488	0	0.0	1000	0.01752	24.18		0.0456	0.0202	-0.8288	9.3013	85.8277	0.8946
	1	3.70%	1.59	0.4	250.0	100	0.019579354	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	45.72	5488	0	0.0	1000	0.01013	13.98		0.0456	0.0202	0.0185	10.1486	102.9933	0.5172
	1	3.70%	1.59	0.4	250.0	100	0.019579354	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	53.34	5488	0	0.0	1000	0.00240	3.31		0.0456	0.0202	0.8657	10.9958	120.1588	0.1225
PCB	1	3.70%	1.59	0.4	250.0	100	0.019579354	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	60	5488	0	0.0	1000	0.00026	0.36		0.0456	0.0202	1.6063	11.7363	135.1618	0.0134
	0.1	3.70%	1.59	0.4	250.0	100	0.001957935	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	30	5488	0	0.0	1000	0.00195	2.69		0.0456	0.0202	-1.7294	8.4007	67.5809	0.9944
	0.1	3.70%	1.59	0.4	250.0	100	0.001957935	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	38.1	5488	0	0.0	1000	0.00175	2.42		0.0456	0.0202	-0.8288	9.3013	85.8277	0.8946
	0.1	3.70%	1.59	0.4	250.0	100	0.001957935	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	45.72	5488	0	0.0	1000	0.00101	1.40		0.0456	0.0202	0.0185	10.1486	102.9933	0.5172
	0.1	3.70%	1.59	0.4	250.0	100	0.001957935	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	53.34	5488	0	0.0	1000	0.00024	0.33		0.0456	0.0202	0.8657	10.9958	120.1588	0.1225
PCB	0.1	3.70%	1.59	0.4	250.0	100	0.001957935	0.0125	3.42E-06	111	0.10%	1,380,384	1,380	60	5488	0	0.0	1000	0.00003	0.04		0.0456	0.0202	1.6063	11.7363	135.1618	0.0134

Table E-5
Armor Stone Size Calculations

S_f	C_s	C_v	C_t	C_g	K_1	d	V	$\tilde{a}_s$	$\tilde{a}_w$	g	D_{50}
Safety Factor	**Stability Coefficient**	**Velocity Distribution Coefficient**	**Blanket Thickness Coefficient**	**Gradation Coefficient**	**Side slope Correction Factor**	**Water Depth (ft)**	**Water Velocity (ft/s)**	**Unit Weight of Stone (lb/ft^3)**	**Unit Weight of Water (lb/ft^3)**	**Gravitational Constant (ft/s^2)**	**Median Stone Size Required to Withstand Erosion (ft diameter)**
Upstream Section of Lower Ley Creek											
1.1	0.375	1.25	1	1.518	0.88	3	9.5	165	62.4	3.22E+01	**1.36049**
Middle Section of Lower Ley Creek											
1.1	0.375	1.25	1	1.518	0.88	4	5	165	62.4	3.22E+01	**0.25444**
Downstream Section of Lower Ley Creek											
1.1	0.375	1.25	1	1.518	0.88	10	4	165	62.4	3.22E+01	**0.11583**

Notes:
ft - feet
s - seconds
lb - pounds